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Behavioral Accident Simulator Computer Program User Guide and Technical Reference Manual

By William E. Souder



UNITED STATES DEPARTMENT OF THE INTERIOR



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By William E. Souder

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Donald Paul Hodel, Secretary**

**BUREAU OF MINES
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BEHAVIORAL ACCIDENT SIMULATOR COMPUTER PROGRAM USER GUIDE AND TECHNICAL REFERENCE MANUAL

By William E. Souder¹

ABSTRACT

The behavioral accident simulator (BAS) is a computer program that can be used to simulate accident situations. It demonstrates how the potential to have an accident grows or diminishes as a result of changes in various environmental, organizational, and behavioral factors. It calculates the number of fatalities that may result from various conditions and graphically displays these data. The BAS is useful for studying systems of accident causes, for demonstrating the various ways to diminish fatalities, and for training employees. This Bureau of Mines report provides the detailed instructions needed to use the BAS.

INTRODUCTION

This report describes the technical aspects and the use of the behavioral accident simulator (BAS). The development and construction of the BAS is described in Bureau of Mines Information Circular (IC) 9178.²

The BAS allows the user to model accident situations by supplying the data for several parameters. Depending on how these data are chosen, various environmental, psychological, behavioral, and management factors come into play. These factors interact and impact on the BAS data base and the BAS network of variables to simulate unsafe acts, accident potentials, and human accidents.

The BAS demonstrates how the potential to have an accident grows or diminishes as a result of various factors, calculates the number of fatalities that will result if these factors are allowed to remain, and graphically displays these results. The BAS is useful for studying systems of accident causes and for demonstrating the various ways in which fatalities can be diminished.

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²Souder, W. E. A Catastrophe-Theory Model for Simulating Behavioral Accidents. BuMines IC 9178, 1988, 19 pp.

SECTION 1.--TECHNICAL SUMMARY

NETWORK FLOW VARIABLES

The BAS is a deterministic network flow algorithm that uses fixed flow values for each route and each node. Except for the various parameters and feedback routes subsequently described, the configuration of the network (numbers of routes, numbers of nodes, locations of routes, and values of the routes) cannot be changed by the BAS user.

The network variables are--

VNI = the network flow value at node I = 1 to N nodes in the network; these values are outputs from the program,

and

VRIJ = the flow frequency of route IJ between nodes I and J; these values are inputs for the BAS program calculations.

Figure 1 shows the BAS network model. The nodes are not numbered in ascending order. Rather, they are uniquely identified according to the variables they represent, as given in IC 9178.

DATA BASE AND USER INPUTS

One portion of the BAS computer program consists of a fixed data base of 32 VRIJ numbers. These numbers are an integral part of the BAS. They were empirically derived from actual accident situations in underground mining as discussed in IC 9178. Though they are inputs to the BAS algorithm, they are not manipulatable by the user. Rather, they are part of a fixed data base that is under the control of the BAS computer program. Each VRIJ

is the flow frequency from node I to node J in figure 1. For example, VR67 = 0.82 means that node 6 (carefulness) leads to node 7 (safety initiatives) 82% of the time. For more details about these and other variables in the BAS see IC 9178.

Another input to the program consists of 17 parameters that are specified by the BAS user to model particular situations or conditions. These parameters are organized into eight network preprocessors (fig. 1): the environmental conditions (EC) preprocessor, the physiological abilities state (PS) preprocessor, the adjustive behavior (JB) preprocessor, the supervisor abilities (FA) preprocessor, the adjustive behavior override (IF) preprocessor, the psychological conditions (PC) preprocessor, the managerial conditions (MC) preprocessor, and the behavioral conditions (BC) preprocessor. The BAS user makes changes in the 17 parameters, which cause changes in these preprocessors. The preprocessors then impact on the data base of VRIJ's and the network node system. This produces the outputs from the BAS.

BAS OUTPUTS

The BAS program calculates, interprets, and prints out the network flow values at each of the numbered nodes in the network in figure 1, with node 27 being the final terminus. The network flow values are designated as VNI for value at nodes I = 1 to N. These values represent the accident system entropies of each state (node) in the system. Several levels and types of interpretive reports are available on these flows, as specified by the user.

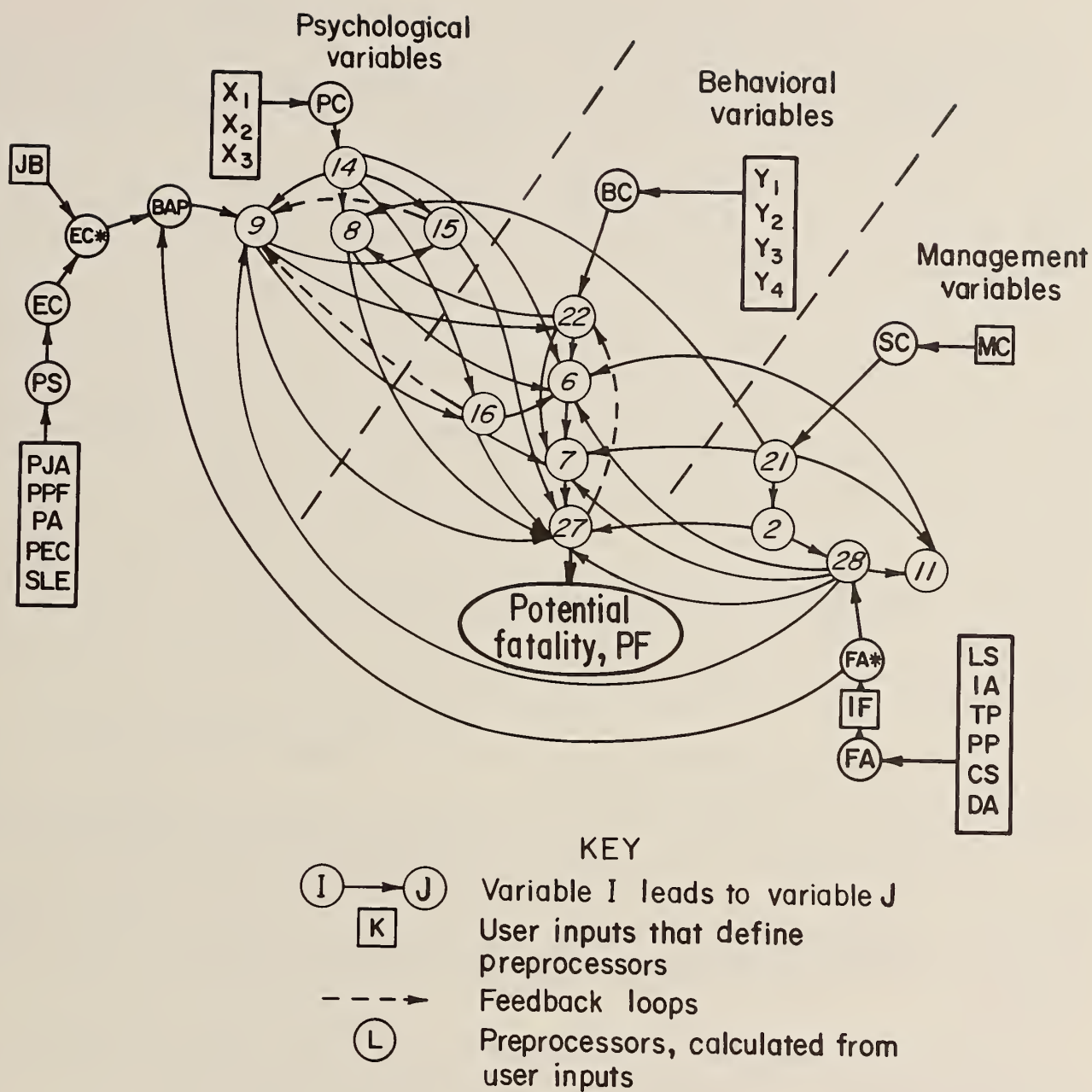


FIGURE 1.—BAS network.

SECTION 2.--TECHNICAL GUIDE TO USING PREPROCESSORS

ENVIRONMENTAL CONDITIONS (EC)
PREPROCESSOR SCALE

Behavioral accidents result from the dynamic interplay of many opposing forces, cumulating and building to a crescendo that causes the individual to commit an unsafe, irrational act (see IC 9178). Environmental conditions are one of the important forces that lead to behavioral accidents, because they result in a kind of psychological overload or underload within the individual. The end result of this chain of events can be inattention, dissatisfaction, boredom, recklessness, forgetfulness, fatigue, and shortened reaction times. Such situations carry a high potential for an accident.

Thus, the following five variables are used in the environmental preprocessor. The symbols in parentheses are the variable names that are used in the BAS computer program.

1. Job physical annoyances (PA). The more dirty and annoying the job, the higher the potential for accidents.

2. Production pressure and fatigue (PPF). Felt pressures to get out the product can directly affect one's mental acuity and physical efficiency, thus resulting in increased potentials for accidents.

3. Perceived job-role ambiguity (PJA). An individual who does not understand the nature and importance of his/her job in the total mine system is subject to a variety of noxious impacts that favor accidents.

4. Perceived economic climate and job rewards (PEC). The more the employee feels trapped in an underpaid, lowly esteemed job, the greater the potential for accidents.

5. Stressful personal life events (SLE). The death of a spouse, a personal

financial problem, etc., can severely hamper one's job performance and lead to accidents.

To obtain the data for the above five variables, the BAS user consults the series of scales in tables 1, 2, 3, 4, and 5. For example, if the job is "very clean and very quiet," the BAS user rates the variable PA as "low" and correspondingly sets PA = 10 as shown in table 1. Note that these scales are illustrative only. Scale positions and corresponding values in between those shown for "low" and "high" can be added by the user by interpolation in tables 1, 2, 3, and 4. Scale positions and values can similarly be added between "maximum" and "none" in table 5. The BAS uses a series of equations (see section 5) to combine the data for these five variables into the environmental preprocessor, EC, which eventually enters node 9 in figure 1.

PHYSIOLOGICAL ABILITIES STATE (PS)
PREPROCESSOR SCALE

If the individual experiencing the various environmental conditions also has some physiological inabilities (e.g., impaired hearing, poorly developed muscle structures), his/her accident potential may thereby be increased. Following are four physiological inabilities:

1. Inadequate physical strength,
2. Physical impairment,
3. Improper or inadequate training for the job,

and

4. Working when physically injured.

The BAS uses a variable "physiological abilities state" (PS) to represent these conditions. The scale for the PS variable is shown in table 6.

TABLE 1. - Scale 1, job physical annoyances (PA)

Scale position	Scale position description	PA =
Low.....	This job is very clean and very quiet.	10
Moderate.....	This job is "about average" for cleanliness and quietness of environment ("what one would expect, not too bad for what it is, typical for this industry").	40
High.....	This job is excessively noisy, dusty, dirty and environmentally abrasive ("cannot hear yourself think, covered with grime at the end of the shift, about the worst job there is for dirt and noise").	100

TABLE 2. - Scale 2, production pressure and fatigue (PPF)

Scale position	Scale position description	PPF =
Low.....	Personnel are generally well rested, have not recently experienced many pressures to produce, and are not preoccupied with achieving high outputs at the expense of safety or personal health.	10
Moderate.....	There is concern for output, though the environment and/or management does not excessively emphasize this aspect.	50
High.....	Personnel feel excessive pressures to get out the product and they are weary from their efforts.	100

TABLE 3. - Scale 3, perceived job-role ambiguity (PJA)

Scale position	Scale position description	PJA =
Low.....	This job or role is well defined, the responsibilities and duties are well understood by all and the performance standards are well established.	10
Moderate.....	This job or role is not well defined, there is some uncertainty as to the duties and responsibilities, and the performance standards are only partially established.	60
High.....	This job or role is undefined, there is total uncertainty about the duties and responsibilities, and there are no established performance standards.	100

TABLE 4. - Scale 4, perceived economic climate and job rewards (PEC)

Scale position	Scale position description	PEC =
High.....	Personnel are satisfied with the rewards and climate.	10
Medium.....	There is some dissatisfaction, but it is only moderate and confined to a few persons.	40
Low.....	Personnel feel underpaid and underappreciated.	100

TABLE 5. - Scale 5, stressful personal life events (SLE)¹

Scale position	Scale position description	SLE =
Maximum.....	Events create stresses beyond the extreme.....	100
Extreme.....	Death of loved one or close family member.....	75
Do.....	Divorce.....	75
Do.....	Separation from spouse.....	75
Do.....	Jail term.....	75
Major.....	Injury or personal illness (serious).....	50
Do.....	Marriage.....	50
Do.....	Health change of family member.....	50
Do.....	New family member, e.g., a new baby.....	50
Do.....	Business readjustment.....	50
Do.....	New mortgage.....	50
Do.....	Foreclosure on home or car, etc.....	50
Do.....	Work assignment change.....	50
Do.....	On-job argument with supervisor.....	50
Minor.....	Son or daughter leaving home.....	25
Do.....	In-law problems.....	25
Do.....	Wife starts or stops working outside home.....	25
Do.....	Work hours change.....	25
Do.....	Residence change.....	25
Do.....	Vacation.....	25
Do.....	Christmas.....	25
Do.....	Minor violations of the law.....	25
Do.....	On-job arguments with peers.....	25
None.....	No events of any significance.....	0

¹ If more than one stressful personal life event exists, use the highest scoring SLE and discard the others.

Source: Rahe, L. O., and T. H. Holmes. Scaling of Life Change: Comparison of Direct and Indirect Methods. J. Psychosom. Res., v. 15, No. 3, 1971, pp. 223-226.

TABLE 6. - Scale 6, physiological abilities state (PS)

Scale position	Scale position description	PS =
Adequate.....	The individual is physically qualified and physiologically adequate for this job.	1
Inadequate.....	The individual is physically inadequate and/or not physically qualified to do this work.	2

ADJUSTIVE BEHAVIOR (JB) PREPROCESSOR SCALE

The potential to have an accident can either be lessened or further enhanced, depending on the adjustive behaviors and

copmg mechanisms the individual brings to play in reacting to the environment. For instance, if the individual reacts by becoming aggressive (e.g., "get out of my way, I'll fix that thing!"), the potential for an accident can suddenly

escalate at an exponentially increasing rate. But, suppose the individual engages in some adaptive mechanisms, i.e., he/she calmly considers the options and adapts his/her behavior to the circumstances. Then the accident potential may diminish, along with the originally perceived stresses. The individual who stops and asks himself/herself "why am I upset by this?" is on the way to an adjustive behavior that reduces his/her potential to have a behavioral accident.

Table 7 lists six individual adjustive behaviors, i.e., ways the individual may react to the stressors. The BAS uses the variable JB to represent these behaviors. The BAS user must specify a value for JB, using the scales shown in table 7. The BAS uses a set of equations to combine the environmental conditions (EC) and adjustive behavior (JB) scores into EC* which is one of the inputs to node 9 in figure 1.

TABLE 7. - Scale 7, adjustive behavior (JB)

Adjustive behavior or reaction	JB =	Examples of this type of reaction
Aggression.....	0	Fixation = stubborn, persistent nonadjustive reaction in the face of cues that this is ineffective behavior. Displacement = misplaced direction of pent-up emotions toward the "wrong" object.
Withdrawal.....	1	Fantasy = imaginative activity as an escape. Regression = regression to infantile behaviors, in search of solace. Repression = burying psychologically disturbing events from one's consciousness. Flight = physical or mental departure from a psychologically painful situation.
Sublimation.....	2	Replacing the urge with a higher level substitute, but never fully resolving the original issue.
Compromise.....	3	Identification = patterning one's acts after another who is seen as having higher status. Projection = attributing one's own failings to others.
Adaptation.....	4	An adjustment wherein the individual changes behaviors, attitudes, or values to accommodate a stimulus, but fails to make a permanent and complete internal reconciliation. Hence, recidivism to a lower level reaction, e.g., aggression, may appear when the same stimulus reappears.
Consultation.....	5	A complete resolution of the issues by consultative session(s) between the employee and all other affected parties.

SUPERVISOR ABILITIES (FA)
PREPROCESSOR SCALE

The ability of the supervisor to observe and identify stressors as they emerge, to perceive the buildup of behavioral accident potentials within the individual, and to intervene at the appropriate time are key elements in producing an effective adjustive behavior that reduces accident potentials. Environmental conditions, plus the individual's physiological abilities state, create accident potentials. The individual's adjustive behavior, plus the supervisor's abilities, either reduce or enhance the accident potentials.

The supervisor's abilities are scored along the six dimensions listed in table 8. The greater the supervisor's abilities, the lower the likelihood that an accident will occur. The supervisor is scored either "1" if he/she has this ability (he/she is "good" at it), or "0" if he/she does not have this ability (he/she is not "good" at it), for each of the six dimensions in table 8. The supervisor's total score, FA, is the sum of the dimension scores (the 1's and 0's). For example, a "perfect" supervisor would have FA = 6.

TABLE 8. - Scale 8, supervisor's
managerial abilities (FA)

<u>Dimension</u>	<u>Dimension score</u>
Leadership skill (LS).....	1 or 0
Interpersonal skill (IA).....	1 or 0
Technical ability (TP).....	1 or 0
Planning proficiency (PP).....	1 or 0
Communication ability (CS)....	1 or 0
Directing skill (DA).....	1 or 0

ADJUSTIVE BEHAVIOR OVERRIDE
(IF) PREPROCESSOR SCALE

Whatever the supervisor's managerial abilities (FA) score, his/her score may be overridden. For example, a "good" supervisor may not have any effect on the individual, or a "bad" supervisor may be ignored by the individual. To illustrate

this suppose FA = 0, but the individual's behavior = 5. That is, even though this is the worst possible supervisor, the individual is able to fully adjust to the situation. To represent this, i.e., the individual does not depend on the supervisor and can achieve adaptation without the supervisor, IF = 1.0 must be used. See table 9 for more details.

TABLE 9. - Scale 9, adjustive
behavior override (IF)

<u>Case condition or situation</u>	<u>IF =</u>
The individual adjusts his/her own behavior without the supervisor's involvement.....	1
The supervisor influences the individual's adjustive behavior.....	0

PSYCHOLOGICAL CONDITIONS (PC)
PREPROCESSOR SCALE

To be able to avoid accidents, one must be able to perceive various cues and precursors of pending accidents. One must also be able to discriminate between appropriate and inappropriate actions. For example, when following another car on the highway, a small puff of white smoke from the tailpipe of the car ahead often indicates the driver's foot has left the accelerator and the driver is preparing to stop. An appropriate action for the following driver might be to step on the brake. But this might not be appropriate on an icy highway, or where many cars are closely following each other. Thus, judgments are required. One thing that can aid this judgment is formal training in pattern recognition. For example, formal training in the types of smoke patterns that come from the car's exhaust just before deceleration and acceleration can make a driver more alert to such conditions and their meanings. In the BAS, these concepts are combined through a series of equations to create a psychological conditions preprocessor. This preprocessor results in a value for PC, which enters node 14 in figure 1.

To obtain the input data for the psychological conditions preprocessor, the user must supply data for the following parameters: X1, X2, and X3. To supply these data, the user consults the scales shown in tables 10, 11, and 12.

MANAGERIAL CONDITIONS (MC)
PREPROCESSOR SCALE

The amount of concern for safety shown by top management can "set the stage" for

safe behaviors. Using the scale in table 13, the BAS user can specify the degree of top management concern for safety. Additional scale values may be specified by interpolation. Note that the BAS user must use the decimal when entering any data for this variable. The value of MC is used in a series of equations to produce SC, which enters node 21 in figure 1.

TABLE 10. - Scale 10, pattern recognition training (X1)

Scale position	Scale position description	X1 =
Yes.....	This person has recently received formal training in pattern recognition.	1
No.....	This person has not recently received such training.	0
?.....	The rater does not know or cannot tell.....	0

TABLE 11. - Scale 11, alertness (X2)

Scale position	Scale position description	X2 =
Low alertness.....	This person is a poor observer who misses many details and cues that most people would see.	1
High alertness.....	This person is a good observer who sees many things that most people would miss.	0
?.....	The rater does not know or cannot tell.....	0

TABLE 12. - Scale 12, discriminatory abilities (X3)

Scale position	Scale position description	X3 =
Low abilities.....	This person would not know the appropriate actions to take in a sudden emergency, would not know what to do, or how to handle it.	1
High abilities.....	This person would know the appropriate actions to take in a sudden emergency.	0
?.....	The rater does not know or cannot tell.....	0

TABLE 13. - Scale 13, top management concern for safety (MC)

Scale position	Scale position description	MC =
Maximum concern....	Top management shows the maximum concern possible.....	1
Modal concern.....	Top management shows average concern.....	.5
Minimal concern....	Top management shows the lowest concern possible.....	0

BEHAVIORAL CONDITIONS (BC)
PREPROCESSOR SCALE

Persons who consistently take unnecessary risks or act in a macho fashion may have (or cause) more accidents than less radical-behaving persons. This might be especially so where others emulate this behavior. Even persons who occasionally act in radical ways may have (or cause)

more accidents than those who consistently behave more conservatively. Thus, these considerations are combined through various equations to calculate BC, the behavioral preprocessor, which enters node 22 in figure 1. The BAS user consults the scales shown in tables 14, 15, 16, and 17 to define the four parameters that are the components of BC.

TABLE 14. - Scale 14, volatility (Y1)

Scale position	Scale position description	Y1 =
High.....	This person often goes off half-cocked or seldom "looks before he/she leaps," is an emotional thinker, plans little, or takes unnecessary risks.	1
Low.....	This person plans a great deal, considers every alternative action before committing to one action, and is normally a rational thinker.	0
?.....	The rater does not know or cannot tell.....	0

TABLE 15. - Scale 15, machoism (Y2)

Scale position	Scale position description	Y2 =
High.....	This person has a need to demonstrate his/her "manliness," does things "his/her own way," conventional ways of doing things.	1
Low.....	This person has high regard for conventional rules and seldom "shows off."	0
?.....	The rater does not know or cannot tell.....	0

TABLE 16. - Scale 16, consistency (Y3)

Scale position	Scale position description	Y3 =
High.....	This person shows predictable, consistent behavior from day to day.	1
Low.....	This person shows inconsistent behavior from one day to the next.	0
?.....	The rater does not know or cannot tell.....	0

TABLE 17. - Scale 17, influence (Y4)

Scale position	Scale position description	Y4 =
High.....	Others often emulate this person.....	1
Low.....	Few people ever emulate this person.....	0
?.....	The rater does not know or cannot tell.....	0

SECTION 3.--OTHER INPUT DATA: FEEDBACK LOOPS

FEEDBACK CONCEPTS

Behavioral reinforcement feedbacks can occur as a result of any personal, vicarious, or social learning experience. A person who does something once with favorable results is likely to do it again (personal learning experience). A person may try something simply because he/she thinks about it longingly and the idea is appealing (vicarious learning). In addition, a person may copy the behaviors of his/her peers (social learning).

Personal experiences and social learning may not by themselves change behaviors. However, they may affect a person's psychological set, which can then change that person's behaviors. To illustrate, suppose a person is not characteristically highly impulsive. But one day, in a hurry, the person makes a snap judgment on the basis of scanty information. Let us further suppose that although this snap judgment used a faulty decision process, an accident did not result. Because of this experience, the next time the person encounters a situation like this one, the person's cognitive decision process (psychological set) and the person's impulsivity (behavior) may be out of character. That is, the person may try to repeat the most recent snap decision and quick behavior. The point is that one successful snap decision (behavior) can alter one's psychological set (cognitive decision-making process). This is a feedback effect, as opposed to the main effect running from psychological set to behavior. For many individuals, such feedbacks may be 10% or 20% as important as the main effect.

BUILDING FEEDBACK LOOPS

The BAS allows the user to build three independent feedback loops into the network. As shown by the broken lines in figure 1, these three are from node 15 to node 9, from node 16 to node 9, and node 27 to node 22. The feedback loop from node 27 to node 22 means that once node 27 has reached its terminus, it can feed back into node 22. This feedback

says that once poor employee judgments (node 27) occur, they can further decrease an individual's degree of compliance with safe procedures (node 22). This, in turn, feeds back into the individual's judgments (node 27), causing those judgments to be even poorer than they would have been without feedbacks. Similarly, the feedback loop from node 15 to node 9 causes individuals to have lower self-control. And the feedback loop from node 16 to node 9 causes individuals to be more impulsive. For more details about these variables, the reader is referred to IC 9178.

To include any feedback loop, the user simply inputs a feedback coefficient, FCJI for that particular feedback route JI, corresponding to forward loop IJ. The FCJI numbers, which must be less than 1.0, represent the portion of the value of direct route IJ to be attributed as the value of feedback route JI. For example, $FC159 = 0.20$ means that the value of the feedback route from node 15 to node 9 in figure 1 is 20% of the value of the route from node 9 to node 15. The feedback variables are--

FCJI = feedback coefficient for feedback route JI (input)

VFRJI = value of feedback route JI (output from the BAS).

Normally, feedback coefficients will not exceed 0.50. Typically, feedback coefficients range from 0.10 to 0.30. The choice of an appropriate feedback coefficient is a matter of the user's judgment.

SETTING FEEDBACK COEFFICIENTS

Normally, on the average, involvement in a group situation will reinforce individual human behaviors about 20% of the time. This means that if an individual is impulsive and the other group members copy this behavior, their behavior will in turn cause the individual to be 20% more impulsive. This would be coded in the BAS as a feedback coefficient of 0.20. Specifically, three feedback loop

commands will appear when running the BAS: "INPUT FC VALUE FOR FEEDBACK LOOP 25 TO 13," "INPUT FC VALUES FOR FEEDBACK LOOP 24 TO 13," and "INPUT FC VALUES FOR FEEDBACK LOOP I TO C." Here, FC is the feedback coefficient. In the general case, each of these commands would be responded to by typing in the number 0.20.

If the user feels that the group is more influential, then the value of the coefficient should be increased to 0.30, 0.40, etc. As noted above, numbers greater than 0.50 would be extraordinary. For example, a feedback coefficient of 0.60 for poor self-control (feedback from node 15 to node 9) says that every act of poor self-control by the individual is perfectly copied 60% of the time by all the group members, and this is then perfectly recopied by the individual 100% of the time. The net result is that the individual now demonstrates 60% self-control as a result of interactions with the group. A 20% feedback is more typical, e.g., individual behaviors are normally no more than about 20% more pronounced as a result of interacting with behavior-reinforcing peers. For less influential groups, the coefficient should be accordingly decreased, i.e., a person may be only slightly influenced by his/her peers.

The presence of three feedback loops within the BAS provides great flexibility in modeling group influences, as follows. For example, suppose the BAS user feels that Mr. ABC, who is being modeled in the BAS, is basically an impulsive person. Suppose the BAS user feels that this is likely to cause other persons who work around Mr. ABC to become more impulsive. And suppose the BAS user feels that this will, in turn, further reinforce Mr. ABC to become even more impulsive. This is the essence of group-individual behavioral feedbacks. In this case, the feedback loop from node 16 to node 9 in figure 1 should be coded in the BAS to reflect this. Thus, in response to the BAS program command "INPUT FC VALUES FOR FEEDBACK LOOP 25 TO 13" the BAS user would enter a number between 0.0 and 1.0. This is the feedback coefficient or FC value, as noted above. As noted above,

the FC values should not exceed 0.50, and the usual value is 0.20. Note that this command refers to the feedback loop from node 25 to node 13, while figure 1 numbers the nodes differently. This is simply an artifact of the computer program node numbering system and is of no consequence to the BAS user. All the user needs to remember is which loop controls which variables.

The feedback loop from node 15 to node 9 in figure 1 allows the BAS user to model group influences having to do with poor self-control. For example, suppose the BAS user feels that Mr. ABC lacks self-control. That is, he "flies off the handle" at slight provocations or otherwise appears to lack the ability to maintain a studied, logical approach to threats and cries. Assume that the BAS user feels this will diminish the self-control of others around Mr. ABC. And assume the BAS user feels that their diminished self-control will eventually cause Mr. ABC to have even less self-control. This is the essence of group-individual behavioral feedbacks. Then, in response to the command "INPUT FC VALUE FOR FEEDBACK LOOP 24 TO 13," the BAS user would enter a number between 0.0 and 1.0, as discussed above for feedback loops.

The feedback loop from node 27 to node 22 in figure 1 allows the BAS user to model feedbacks due to poor judgments. If the BAS user feels the individual being modeled in the BAS exhibits poor judgment, and that this individual will be subject to group-individual behavioral feedbacks, then this is the feedback loop that should be used. In response to the command "INPUT FC VALUE FOR FEEDBACK LOOP I TO C," the BAS user would enter a number between 0.0 and 1.0, analogous to the above discussions for the other feedback loops.

In summary, there are three feedback loops. The command "INPUT FC VALUE FOR FEEDBACK LOOP 25 TO 13" is for impulsivity. The command "INPUT FC VALUE FOR FEEDBACK LOOP 24 TO 13" is for self-control. And the command "INPUT FC VALUE FOR FEEDBACK LOOP I TO C" is for poor judgment. The normal FC value is 0.20.

A larger or smaller number is used when each of these feedback effects is larger or smaller, respectively, than normal.

Since feedbacks are the result of group phenomena, breaking up the group, removing the influential person causing the problem, reassigning some personnel to other locations, or intervening in the

group processes are the typical means for diminishing these phenomena. Training, close supervision, or setting a better example for the group are some typical ways of intervening. Thus, the BAS may be used to test the impacts of various actions or interventions.

SECTION 4.--RUNNING BAS

SETTING DATA VALUES

The BAS will run with or without feedback loops. The BAS will run with all the preprocessors set at their minimums, i.e., preprocessors are not used. However, when any preprocessor is used, care must be taken to set its parameters in a way that accurately reflects the scenario that the user derives to simulate.

PROCEDURES FOR USING IBM PC³ VERSION OF BAS

Callup procedures will vary, depending on the nature of the personal computer, e.g., whether it is an IBM or some other IBM-compatible machine, whether the program is stored on a hard disk or a floppy disk, the name it is stored under, etc. Typically, if the program is stored on a floppy disk, after booting and entering the current date and time, the user will see the name of the program appear on the screen. In some other systems, a cursor will appear and the user must enter the program name for the keyboard. The program is usually stored under some name like "BAS" or "FLOW 1," which is its Fortran name. After the program is called up, dialog with the program can begin. The questions to be answered and the actions to be taken by the user will automatically be displayed on the screen. Simply answer the questions as they appear, with the aid of the appropriate scales in tables 1 through 17 and the above discussions.

After the last question, "ENTER A NAME FOR THIS CASE" will appear on the screen. You may enter any combination of four digits or four letters as the case name. If you enter more than four characters, the computer will truncate it to four characters. Then the prompt "NAME UNIT 6" will appear on the screen. You will then have four options. Enter "PRN" to have all the results of the questions printed out on the printer. Enter "CON" to have all the results of the questions appear only on the screen. Enter, "MYFILE" to have all the results of the questions stored on a computer disk, under the file name MYFILE (or any other name you have entered). Enter "CTRL P" to have all the results of the questions printed out on the printer and to appear on the screen simultaneously. (Note: CTRL is the "control" key. You must press the CTRL and P keys simultaneously.)

Anytime you wish to stop the program, just simultaneously press the CTRL and S keys. To start the program once you have stopped it, press any key. When the program is finished, it will give you a list of "DO YOU WANT TO" commands and a menu. You may now continue according to the menu or terminate your work. Should you want to print any file stored on a computer disk before you turn off the computer, e.g., a file named "MYFILE," simply turn on the printer by simultaneously pressing the CTRL and P keys and enter "TYPE MYFILE" at the keyboard. An alternate method is to use the copy command, e.g., type "COPY MYFILE PRN" at the keyboard. Should you want to delete a file, e.g., a file named "TREES" that you have previously stored on the disk, simply

³Reference to specific products does not imply endorsement by the Bureau of Mines.

type "DEL" and the name of the file, i.e., "DEL TREES." To scan the disk to see what is stored there, simply enter "DIR" and the screen will display the file names that are stored on the disk.

PROGRAM LISTING

The Fortran program listing is shown in appendix A. Users may want to develop their own programs around this listing.

OUTPUTS

Several types of reports are available to the user. These may be obtained by simply typing "1" when the BAS accordingly queries the user.

Sample output reports are presented in appendix B. The report entitled "THE INPUT DATA FOR THIS CASE ARE:" is simply a listing of the input data, so that the user can check them. Note that because of programming conventions and restrictions, some of the parameter identifications in the printouts are different from those shown in figure 1. In particular note the following parameter identifications:

<u>In figure 1--</u>	<u>In appendix B--</u>
EC*.....	PI13
PC.....	VN23
SC.....	VNA
MC.....	XNA
BC.....	VNCI
FA.....	XMA
IF.....	AJBO
JB.....	XAJB

Another report is the "DETAILED OUTPUT REPORT." The entropy values in this report are the cumulative flows at each of the nodes in figure 1. This report is very useful for following the buildup of flows through the network. Note that

because of the way the computer program assigns node numbers, the node numbers in the printouts are not the same as those shown in figure 1. In particular, note the following node numbers:

<u>In figure 1--</u>	<u>In appendix B as value at node (VN)</u>
9.....	13
8.....	J
14.....	11
15.....	24
22.....	C
6.....	10
16.....	25
7.....	12
27.....	I
11.....	16

All the other node numbers are the same. Note also that VRCI has a constant value of 1.0 so that $VFRIC = FCIC \times VRCI = FCIC$ in the printouts in appendix B. In general, most users will not care to see the "DETAILED OUTPUT REPORT" and they may not wish to request it. Alternatively, they can allow it to print out and simply ignore it. Users who wish to use it will find more information about it in IC 9178.

In the "SUMMARY REPORT," the %MAX SCORE is the raw score divided by the maximum value for that type of error, for the data provided to the BAS. The message "A BEHAVIORAL THRESHOLD WAS PENETRATED" signifies that a jump shift occurred in the cusp catastrophe model. For more details on this, see IC 9178 and see the discussions in the following section concerning the cusp catastrophe model equations.

The "MANAGEMENT REPORT" summarizes the fatality likelihoods and the "% FATALITIES BY SOURCES." It also graphically displays the %MAX SCORE data from the "Summary report."

SECTION 5.--EQUATIONS

Several equations and mathematical expressions are used within the BAS, as indicated in figure 1:

1. Environmental preprocessor.

$$EC = (TH1 + TH2/10.5)^{1/2}/1.5.$$

The variables TH1 and TH2 are Fortran variables only. They are explained in item number 5 below. The constants 10.5 and 1.5 are scale values. EC is the value of the environmental preprocessor that eventually feeds node 9 of the network in figure 1.

2. Psychological preprocessor.

$$PC = 0.55 + (X2/1.6667 \\ + X3/2.50) - X1/2.0.$$

Here, 0.55 is a scale factor and the divisors are normalizing and/or weighting factors. Subtracting the value for X1 compensates for the effects of training. Thus, $0.50 \leq PC \leq 1.550$. The parameter PC feeds node 14 in figure 1.

3. Management preprocessor.

$$SC = (1 - MC) + (1 - MC)^2/2.0 \\ + 0.05.$$

Here, 0.05 is a scale factor and the second term causes SC to become an exponential function of MC. Note that $0.05 \leq SC \leq 1.55$. The parameter SC feeds node 21 in figure 1.

4. Behavioral preprocessor.

$$BC = ((Y1 + Y2)/2.0) \times (Y3) \\ \times (Y4) + 0.55.$$

Here, 0.55 is a scale factor and the first term is the average of the Y1 and Y2 values. Y3 = 1 or 0.6667, depending on whether consistency occurs and Y4 = 1 or 0.75 depending on whether emulation occurs (see IC 9178). Thus, $0.44 \leq BC \leq 1.550$. The parameter BC feeds node 22 in figure 1.

5. Threshold values.

$$TH1 = ((PJA + PEC + SLE)/95) \\ \times PA \times 1.667.$$

$$TH2 = ((PA + PPF + SLE)/95) \\ \times PS \times 1.667.$$

Here, 95 and 1.667 are scale factors. If either of the Fortran variables TH1 or TH2 are greater than 2.0, a behavioral threshold is penetrated and the exponential cusp catastrophe equations prevail as discussed below.

6. Cusp catastrophe model.

$$XP13 = ((0.3 \times TH1/10)^2)^{1/3}$$

$$YP13 = ((0.3 \times TH2/10)^2)^{1/3}$$

$$CP13 = (XP13 + YP13) \times 1.18.$$

Here, 0.3, 10, and 1.18 are scale factors. XP13, YP13, and CP13 are Fortran variables only. The value of CP13 is the behavioral response (anger, etc.), which is to be offset by either the supervisor's skills (FA) or the individual's adjustive behaviors (JB).

7. Behavior decay.

$$EC^* = DP13 - x, \text{ where}$$

$$DP13 = (TH1 + TH2/10.5)^{1/2}/1.5 \text{ and}$$

$$TH1 \leq 2.0 \text{ or } TH2 \leq 2.0,$$

where TH1 and TH2 are as defined in item 5 above, and DP13 and x are Fortran variables. Here the variable x takes on the sequential values 0.10, 0.20, etc., corresponding to JB = 1, 2, etc. This equation causes the accident-provoking behavior to decay, i.e., just the opposite of the equations in item 6 above (which cause the accident-provoking behaviors to exponentially explode).

8. Behavioral accident potential, BAP.

$$BAP = EC^* - FA^*/10 \text{ for behavior decay, and}$$

$$BAP = CP13 - (FA^*)^{2/3} \text{ for the cusp catastrophe case.}$$

9. The recursive, sequential VNI calculations.

$$VNI = VNX * VRXI + SUM$$

Here, X is the node immediately preceding node I and SU, is the sum of the

value of all other recursives entering any node I.

10. Percent deaths, PD.

$$\text{For } 0 \leq Z \leq 30,$$

$$PD = 0.2667Z + 4.0.$$

$$\text{For } 30 = Z < 90,$$

$$PD = 1.067Z - 20.0.$$

$$\text{For } 90 = Z < 00,$$

$$PD = 0.3333Z + 46.0.$$

Here, Z is the Fortran variable VNK where K is the output of the final network node K. These three equations combine to form a piecewise linear approximation to the continuous, S-shaped function $PD = ((Z)^{ae})^{be}$ where $b, 0$ and $e = 2.718 +$.

11. Chances of being killed, XIC.

$$XIC = (VNK/137.3) \times 12.5$$

Here, the constants 137.3 and 12.5 are scale factors.

SECTION 6.--SAMPLE CASES AND PRINTOUTS

Appendix B contains the sample outputs from the BAS for the following cases 1, 2, 3, 4, and BEST. For more details on the form of these printouts see the above section "Outputs."

CASE 1

Frank is assigned to one of the dirtiest and least attractive jobs at the XYZ mine. Frank believes he is generally underpaid, he works a lot of overtime, and he feels as though he is under a great deal of pressure to "get out the product." Frank's philosophy is "you gotta fight everybody just to stay even in this life." Frank is a generally aggressive person with many pent-up emotions and

a stressful home life. He is a poor observer, often flies off the handle and is prone to react inappropriately to emergencies. He has a consistent need to demonstrate his "Machoism," and he thinks training "is for sissies." Unfortunately, about 20% of the time, Frank influences his peers to act like him. Frank's supervisor is technically competent. But the supervisor is an inadequate planner, director, and leader; has poor interpersonal skills; and does not communicate well with the crew. It should be noted that top management at the XYZ mine is very safety conscious.

Using scales 1-17 (tables 1-17), this case was coded as follows:

PA = 100

PPF = 100

PJA = 100

PEC = 100

SLE = 100

PS = 1.0

JB = 0.0

FA = 1.0

IF = 0.0

X1 = 0.0

X2 = 1.0

X3 = 0.0

MC = 1.0

Y1 = 1.0

Y2 = 1.0

Y3 = 0.0

Y4 = 1.0

Based on the above discussions on feedback loops ("Building Feedback Loops"), let it be assumed that 20% of the time, as stated above in the case, Frank's behavior feeds back into the behavior of others. Therefore, $FC2413 = FC2513 = FCIC = 0.20$ (20% feedback).

CASE 2

Assume Frank's old supervisor is replaced by a new superior-performing supervisor. The corresponding change in the input data from case 1 is $FA = 6.0$.

CASE 3

Assume Frank and his coworkers are all transferred to a better job (or assume that the old job is improved), such that the physical annoyances, production pressures, job ambiguity, and economic rewards are as good as they can be. The corresponding changes in the input data from case 2 are $PA = PPF = PJA = PEC = 10.0$.

CASE 4

Given the potentials for perverse colleague influences ($Y1 = Y2 = 1.0$ and $Y4 = 1.0$), let us see what might happen if the work clique is broken up by transferring Frank and his colleagues to work stations where they do not come into contact with each other. Hence, let us assume that this eliminates the old 20% behavior feedbacks. The changes from case 3 are $FC2413 = FC2513 = FCIC = 0.0$.

CASE BEST

The best possible conditions are

PA = PPF = PJA = PEC = 10.0

SLE = 0.0

PS = 1.0

JB = 0.0

FA = 6.0

IF = 0.0

X1 = 1.0

X2 = 0.0

X3 = 0.0

MC = 1.0

$$Y1 = Y2 = Y4 = 0.0$$

$$BC = 0.275$$

$$Y3 = 1.0$$

$$SC = 0.050$$

$$FC2413 = FC2513 = FCIC = 0.0$$

$$PC = 0.050$$

Note that the above inputs will cause the preprocessors to go to their minimum values, i.e.,

The printouts from the BAS for these five cases are shown in appendix B.

$$BAP = 0.0000$$

APPENDIX A.--BAS FORTRAN LISTING

```

C THIS IS THE FORTRAN PROGRAM FINAL FOR FLOW1
  CHARACTER*5 CSNO
  GO TO 2007
C WHEN MORE THAN ONE CASE IS BEING RUN, MAY KEEP SAME REPORT
FORMAT
1701 CONTINUE
1700  WRITE(*,'(A)')' DO YOU WANT TO KEEP THE SAME REPORT
FORMATS?'
      WRITE(*,'(A)')' TYPE 1 FOR YES, 0 FOR NO'
      READ(*,1200)ISAME
      IF(ISAME.EQ.1) GO TO 2001
      GO TO 2005
1200  FORMAT(I2)
1201  FORMAT(F1.0)
1202  FORMAT(A5)
1203  FORMAT(F6.0)
1204  FORMAT(6A6)
1205  FORMAT(F6.2)
2007  CONTINUE
C NETWORK FLOW DETAILED OUTPUT REPORTS;  OUT =0.0 IF NOT DESIRED,
C    1.0 IF DESIRED
      GO TO 2005
2055  IREP = 1
C    RESET REPORT FORMATS ONLY
2005  WRITE(*,'(A)')' IF YOU WISH TO SEE DETAILED OUTPUT REPORTS'
      WRITE(*,'(A)')' TYPE 1, OTHERWISE TYPE 0'
      READ(*,1201) OUT
      IF(OUT.EQ.0)GO TO 2000
C IF FLOW IS TO OTHER PART OF THE PROGRAM, RETURN IT TO 2004
2004  CONTINUE
C GIVE A CHOICE OF EXTRA REPORTS TO BE TYPED
      WRITE(*,'(A)')' THERE ARE A VARIETY OF REPORTS AND GRAPHS
WHICH YO
      1U'
      WRITE(*,'(A)')' MIGHT LIKE TO HAVE PRINTED OUT.
      WRITE(*,'(A)')' TYPE 1 TO CHOOSE ONE OR MORE.  OTHERWISE
TYPE 0'
      READ(*,1201) STAGF
      IF(STAGF.EQ.0) GO TO 2000
C NETWORK FLOW SUMMARY REPORT;  SOUT=0.0 IF NOT DESIRED, 1.0 IF
DESIRED
      WRITE(*,'(A)')' IF YOU WISH TO SEE THE NETWORK FLOW SUMMARY
REPORT
      1'
      WRITE(*,'(A)')' TYPE 1, OTHERWISE TYPE 0'
      READ(*,1201) SOUT
      IF (SOUT.EQ.0) GO TO 2003
C IF THE PROGRAM GOES TO ANOTHER AREA RETURN TO 2003
2003  CONTINUE
C MANAGEMENT REPORT;  REM=0.0 IF NOT DESIRED, 1.0 IF DESIRED
      WRITE(*,'(A)')' IF YOU WANT TO SEE THE MANAGEMENT REPORT,
TYPE 1,
      1OTHERWISE TYPE 0'
      READ(*,1201)REM

```



```

        IF(GRF.EQ.0) GO TO 2000
C IF THE FLOW GOES TO ANOTHER PART OF THE PROGRAM RETURN TO 2000
C
C IF NO REPORT FORMS WERE CHOSEN, FURTHER PROCESSING WOULD BE REDUNDANT
    IF(OUT.EQ.1) GO TO 2000
    IF(SOUT.EQ.0) GO TO 2006
    GOTO 2001
2006 WRITE(*,'(A)') ' NO REPORT FORMATS WERE CHOSEN.  AN OUTPUT MUST BE
    CHOSEN'
    GO TO 2005
C
2000 OUT=1
2001 CONTINUE
    IF (IREP.EQ.1) GO TO 994
C INPUT DATA FOR THE VN23 PARAMETERS.
1820 WRITE(*,'(A)') ' ENTER DATA FOR THE PSYCHOLOGICAL STATE PRE-PROCESS
    1OR'
    WRITE(*,'(A)') ' ENTER ONLY 0 OR 1, NO OTHER'
    WRITE(*,'(A)') ' FOR TRAINING: 1 = PERSON HAS BEEN TRAINED IN PATTE
    1RN RECOGNITION'
    WRITE(*,'(A)') ' 0 = NO TRAINING, OR DO NOT KNOW'
    READ(*,1201)X1
    WRITE(*,'(A)') ' FOR ALERTNESS: 1 = POOR OBSERVER, MISSES DETAILS'
    WRITE(*,'(A)') ' 0 = HIGHLY ALERT, VERY OBSERVANT OR DO NOT KNOW'
    READ(*,1201)X2
    WRITE(*,'(A)') ' FOR DISCRIMINATORY ABILITIES: 1 = POOR DISCRIMINAT
    1OR'
    WRITE(*,'(A)') ' PERSON MIGHT NOT KNOW APPROPRIATE ACTION IN AN EME
    1RGENCY'
    WRITE(*,'(A)') ' 0 = GOOD DISCRIMINATOR, KNOWS APPROPRIATE ACTION O
    1R DO NOT KNOW'
    READ(*,1201)X3
C CALCULATE PSYCHOLOGICAL PRE-PROCESSOR; 1ST CALCULATE NORMALIZED VALUES
    EX1 = (X1)/2.0
    EX2 = (X2)/1.6666
    EX3 = (X3)/2.5
C CALCULATE NODE 23 VALUE
    VN23 = 0.55 + (EX2 + EX3) - EX1
    IF(ICHGP.EQ.1) GO TO 994
C INPUT DATA FOR THE MANAGEMENT VNA PARAMETERS
1840 WRITE(*,'(A)') ' ENTER DATA FOR MANAGERIAL PRE-PROCESSOR'
    WRITE(*,'(A)') ' YOU MAY ENTER ANY NUMBER FROM 0 TO 1.0; '
    WRITE(*,'(A)') ' MODAL VALUE = 0.50'
    WRITE(*,'(A)') ' 1.0 = TOP MANAGEMENT SHOWS THE MAXIMUM CONCERN POS
    1SIBLE'
    WRITE(*,'(A)') ' FOR SAFETY; 0 = TOP MANAGEMENT SHOWS MINIMUM '
    WRITE(*,'(A)') ' CONCERN FOR SAFETY.  VALUES RANGE FROM 0 TO 1.0.'
    READ(*,1205)XNA
C CALCULATE MANAGEMENT PRE-PROCESSOR; CALCULATE EXPONENTIAL COMPONENT
    ADD = ((1-XNA)**2)/2.0
C DETERMINE VALUE AT NODE A
    VNA = (1-XNA) + ADD + 0.05
    IF(ICHGM.EQ.1) GO TO 994
C INPUT DATA FOR THE VNCI PARAMETERS

```

```

1830 WRITE(*,'(A)')' ENTER DATA FOR BEHAVIORAL PRE-PROCESSOR'
      WRITE(*,'(A)')' FOR VOLATILITY: 1 = PERSON IS UNINFORMED,'
      WRITE(*,'(A)')' GOES OFF HALF-COCKED OR SELDOM LOOKS BEFORE HE LEA
1PS'
      WRITE(*,'(A)')' OR TAKES UNNECESSARY RISKS'
      WRITE(*,'(A)')' 0 = LOW OR NO RISK TAKING, OR DO NOT KNOW'
      READ(*,1201)Y1
      WRITE(*,'(A)')' FOR MACHOISM: 1 = DOES THINGS HIS OWN WAY, HAS '
      WRITE(*,'(A)')' LITTLE REGARD FOR RULES, CONVENTIONS OR PROCEDURES
1'
      WRITE(*,'(A)')' 0 = LOW MACHOISM OR DO NOT KNOW'
      READ(*,1201)Y2
      WRITE(*,'(A)')' FOR CONSISTENCY: 1 = PERSON SHOWS CONSISTENT BEH
1AVIORS'
      WRITE(*,'(A)')' 0 = BEHAVIORS CHANGE FROM DAY TO DAY, OR DO NOT KN
1OW'
      READ(*,1201)Y3
      WRITE(*,'(A)')' FOR INFLUENCE: 1 = OTHERS OFTEN EMULATE HIS BEHAVI
1OR'
      WRITE(*,'(A)')' 0 = OTHERS DO NOT EMULATE HIS BEHAVIOR, OR DO NOT
1KNOW'
      READ(*,1201)Y4
C BEHAVIORAL PRE-PROCESSOR, CALCULATE CORE VARIABLE
      WYE1 = (Y1)/2.0
      WYE2 = (Y2)/2.0
      CORE = (WYE1 + WYE2)
      IF(Y3.EQ.1) GO TO 333
      CON = CORE + 0.55
      GO TO 334
C DISCOUNT THE CORE VARIABLE FOR CONSISTENCY
333 CON = (CORE + 0.55) * 0.6667
334 IF(Y4.EQ.0) GO TO 335
C DETERMINE THE VALUE AT NODE C
      VNCI = CON
      GO TO 336
C DISCOUNT THE CON VARIABLE IF THE PERSONS PEERS ARE NOT INFLUENCED
C AND DETERMINE THE VALUE AT NODE C
335 VNCI = 0.75 * CON
336 CONTINUE
C 1920 WRITE(*,'(A)')' YOU MUST ENTER EITHER A 0 OR 1.'
1920 CONTINUE
      IF(ICHGB.EQ.1) GO TO 994
C INPUT DATA FOR THE THREE FEEDBACK COEFFICIENTS
1860 WRITE(*,'(A)')' DO YOU WANT TO INCLUDE FEEDBACK LOOPS? TYPE 1 FOR
1 YES'
      WRITE(*,'(A)')' TYPE 0 FOR NO.'
      READ(*,1200)IFEED
      IF(IFEED.EQ.0) GO TO 1900
      WRITE(*,'(A)')' INPUT FC VALUE FOR FEEDBACK LOOP 25 TO 13.'
      WRITE(*,'(A)')' VALUES CAN BE FROM 0 TO 1.0; MODAL VALUE = .20'
      READ(*,1205)FC2513
      WRITE(*,'(A)')' INPUT FC VALUE FOR FEEDBACK LOOP 24 TO 13'
      WRITE(*,'(A)')' VALUES CAN BE FROM 0 TO 1.0; MODAL VALUE = .20'
      READ(*,1205) FC2413

```

```

WRITE(*,'(A)')' INPUT FC VALUE FOR FEEDBACK LOOP I TO C'
WRITE(*,'(A)')' VALUES CAN BE FROM 0 TO 1.0; MODAL VALUE = .20'
READ(*,1205)FCIC
GO TO 1910
1900 FC2513=0.0
    FC2413=0.0
    FCIC=0.0
1910 VRCI = 1.0
    IF(ICHGF.EQ.1) GO TO 994
C INPUT DATA FOR THE THIRTY-TWO ROUTE VARIABLES
C FOLLOWING ARE THE DETERMINISTIC ROUTE VARIABLES
    VRA2 = .74
    VR2J = .82
    VRJ16 = 1.0
    VRA16 = .85
    VR2313 = .84
    VRJ13 = .86
    VR13C = .93
    VR2312 = .89
    VRA12 = .84
    VRC12 = .85
    VR2324 = .88
    VR1324 = .76
    VR2325 = .86
    VR1325 = .81
    VRC10 = .77
    VR1610 = .84
    VRJ10 = .71
    VR2310 = .76
    VR1210 = .85
    VR2510 = .73
    VR1011 = .82
    VRA11 = .87
    VRJ11 = .83
    VRC11 = .88
    VR2511 = .69
    VR11I = .75
    VR2I = .73
    VRJI = .65
    VR13I = .89
    VR12I = .85
    VR25I = .79
    VR24I = .85
C INPUT DATA TO RUN THE ENVIRONMENTAL PRE-PROCESSOR
1811 WRITE(*,'(A)')' ENTER DATA FOR THE ENVIRONMENTAL PRE-PROCESSOR SCA
    1LES.'
    WRITE(*,'(A)')' IF YOU CANNOT DETERMINE A SCALE VALUE, TYPE 0'
    WRITE(*,'(A)')' TO ABORT THE PROGRAM.'
1303 WRITE(*,'(A)')' ENTER THE SCALE VALUE FOR JOB PHYSICAL ANNOYANCE
    (1PA)'
    WRITE(*,'(A)')' RANGE 10-100, 10=LOW'
    READ(*,1203)PA
    IF(PA.EQ.0)GO TO 994
    IF(PA.LT.10.OR.PA.GT.100) GO TO 1301

```



```

        IF(IEPR.EQ.1) GO TO 1810
        GO TO 1302
C ERROR ROUTINE HERE
1301  WRITE(*,'(A)')' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
        WRITE(6,620)PA
        GO TO 1303
1302  WRITE(*,'(A)')' ENTER A VALUE FOR PRODUCTION PRESSURE AND FATIGUE
1 (PPF)'
        WRITE(*,'(A)')' RANGE 10-100, 10=LOW'
        READ(*,1203)PPF
        IF(PPF.EQ.0)GO TO 994
        IF(PPF.LT.10.OR.PPF.GT.100) GO TO 1304
        IF(IEPR.EQ.2) GO TO 1810
        GO TO 1305
C ERROR ROUTINE HERE
1304  WRITE(*,'(A)')' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
        WRITE(6,620)PPF
        GO TO 1302
1305  WRITE(*,'(A)')' ENTER A VALUE FOR PERCEIVED JOB AND ROLE AMBIGUITY
1 (PJA)'
        WRITE(*,'(A)')' RANGE 10-100, 10=LOW'
        READ(*,1203)PJA
        IF(PJA.EQ.0) GO TO 994
        IF(PJA.LT.10.OR.PJA.GT.100) GO TO 1306
        IF(IEPR.EQ.3) GO TO 1810
        GO TO 1307
C ERROR ROUTINE
1306  WRITE(*,'(A)')' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
        WRITE(6,620)PJA
        GO TO 1305
1307  WRITE(*,'(A)')' ENTER A VALUE FOR PERCEIVED ECONOMIC CLIMATE AND J
10B '
        WRITE(*,'(A)')' REWARD (PEC). RANGE 10-100, 10=HIGH'
        READ(*,1203) PEC
        IF(PEC.EQ.0) GO TO 994
        IF(PEC.LT.10.OR.PEC.GT.100)GO TO 1308
        IF(IEPR.EQ.4) GO TO 1810
        GO TO 1309
C ERROR ROUTINE
1308  WRITE(*,'(A)')' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
        WRITE(6,620)PEC
        GO TO 1307
1309  WRITE(*,'(A)')' ENTER A VALUE FOR STRESSFUL PERSONAL LIFE EVENTS
1 (SLE)'
        WRITE(*,'(A)')' ENTER ANY NUMBER FROM 0 TO 100. '
        WRITE(*,'(A)')' 100 = MAXIMUM, 0 = NO STRESSFUL EVENTS'
        READ(*,1203)SLE
        IF(SLE.LT.0.OR.SLE.GT.100) GO TO 1310
        IF(IEPR.EQ.5) GO TO 1810
        GO TO 1311
C ERROR ROUTINE
1310  WRITE(*,'(A)')' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
        WRITE(6,620)SLE
        GO TO 1309

```

```

1311 WRITE(*,'(A)')' ENTER A VALUE FOR PHYSIOLOGICAL ABILITY STATE (PS
1)'
WRITE(*,'(A)')' ENTER EITHER 1 OR 2. 1=ADEQUATE, 2=INADEQUATE'
READ(*,1201)PS
IF(PS.EQ.0) GO TO 994
IF(PS.LT.1.OR.PS.GT.2) GO TO 1312
IF(IEPR.EQ.6) GO TO 1810
GO TO 1313
C ERROR ROUTINE
1312 WRITE(*,'(A)')' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
WRITE(6,620)PS
GO TO 1311
1313 WRITE(*,'(A)')' DETERMINE THE VALUE OF FOREMAN MANAGERIAL ABILITIE
1S (XMA)'
WRITE(*,'(A)')' RATE THE FOLLOWING SIX CRITERIA, EITHER 1 OR 0'
WRITE(*,'(A)')' 1 = HE HAS THE SKILL; 0= HE DOES NOT HAVE THE SKIL
1L'
WRITE(*,'(A)')' LEADERSHIP SKILL, ENTER 1 OR 0'
READ(*,1201)XM1
WRITE(*,'(A)')' INTERPERSONAL SKILL, ENTER 1 OR 0'
READ(*,1201)XM2
WRITE(*,'(A)')' TECHNICAL SKILL, ENTER 1 OR 0'
READ(*,1201)XM3
WRITE(*,'(A)')' PLANNING SKILL, ENTER 1 OR 0'
READ(*,1201)XM4
WRITE(*,'(A)')' COMMUNICATION SKILL, ENTER 1 OR 0'
READ(*,1201)XM5
WRITE(*,'(A)')' DIRECTING SKILL, ENTER 1 OR 0'
READ(*,1201)XM6
XMA=XM1+XM2+XM3+XM4+XM5+XM6
IF(XMA.GT.6) GO TO 1314
GO TO 1315
1314 WRITE(*,'(A)')' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
WRITE(6,620)XMA
GO TO 1313
1315 WRITE(*,'(A)')' ENTER ONE NUMBER FOR ADJUSTIVE BEHAVIORS (XAJB)'
WRITE(*,'(A)')' CHOOSE EITHER: 0=AGGRESSION, 1=WITHDRAWAL,2=SUBLIM
1ATION'
WRITE(*,'(A)')' 3=COMPROMISE, 4=ADAPTATION, 5=CONSULTATION'
READ(*,1203)XAJB
IF(XAJB.GT.5) GO TO 1316
IF(IEPR.EQ.8) GO TO 1810
GO TO 1317
1316 WRITE(*,'(A)')' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
WRITE(6,620)XAJB
GO TO 1315
1317 WRITE(*,'(A)')' ENTER A VALUE FOR ADJUSTIVE BEHAVIOR OVERRIDE (AJB
10)'
WRITE(*,'(A)')' ENTER 1 IF INDIVIDUAL ADJUSTS OWN BEHAVIOR WITHOUT
1'
WRITE(*,'(A)')' FOREMAN INVOLVEMENT OR'
WRITE(*,'(A)')' ENTER 0 IF FOREMAN CONTROLS INDIVIDUALS ADJUSTIVE'
WRITE(*,'(A)')' BEHAVIOR'
READ(*,1203)AJBO

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      IF(AJBO.LT.0.OR.AJBO.GT.1) GO TO 1318
      IF(IEPR.EQ.9) GO TO 1810
      GO TO 1319
1318  WRITE(*,'(A)') ' ERROR IN INPUT DATA, CHECK VALUES AND START OVER'
      WRITE(6,620)AJBO
      GO TO 1317

C
1319  IF(IEPR.EQ.10) GO TO 1810
      IF(ICHGE.EQ.1) GO TO 994
200   FORMAT(' ',21X,'VN2=',3X,F7.3,3X,'VNJ=',3X,F7.3)
300   FORMAT(' ',21X,'VN16=',2X,F7.3,3X,'VN13=',2X,F7.3)
400   FORMAT(' ',21X,'VNC=',3X,F7.3,3X,'VN12=',2X,F7.3)
500   FORMAT(' ',21X,'VN24=',2X,F7.3,3X,'VN25=',2X,F7.3)
510   FORMAT(' ',21X,'VN10=',2X,F7.3,3X,'VN11=',2X,F7.3)
520   FORMAT(' ',21X,'VNI=',3X,F7.3)
521   FORMAT(' ',2X,'ERROR IN FC DATA')
530   FORMAT(' ',30X,'ENTROPY VALUES')
531   FORMAT(' ',21X,'ENTROPY VALUES WITH FEEDBACK')
532   FORMAT(' ',29X,'LOOP 24 TO 13')
533   FORMAT(' ',29X,'LOOP 25 TO 13')
534   FORMAT(' ',33X,'AND')
535   FORMAT(' ',29X,'LOOP I TO C')
540   FORMAT(' ',21X,'-----')
541   FORMAT(' ',24X,A20,1X,' = ',F6.3)
600   FORMAT(' ',A1,1X,' = ',F7.3)
601   FORMAT(' ',36X,A6,1X,' = ',F6.3)
602   FORMAT(' ',38X,A6,2X,' = ',F6.3)
604   FORMAT(' ',20X,'THE FEEDBACK COEFFICIENTS ARE:')
605   FORMAT(' ',27X,'NETWORK FLOW OUTPUTS')
606   FORMAT(' ',20X,'THE PRE-PROCESSORS ARE:')
607   FORMAT(' ',36X,A6,1X,' = ',F6.1)
608   FORMAT(' ',26X,'DETAILED OUTPUT REPORT')
609   FORMAT(' ',31X,'CASE:',A5)
610   FORMAT(F7.3,2X,F7.3,2X,F7.3,2X,F7.3,2X,F7.3,2X,F7.3,2X,F7.3)
611   FORMAT(' ',9X,'THE INPUT DATA FOR THIS CASE ARE:')
612   FORMAT(' ',2X,'ENVIRONMENTAL DATA (PI13)')
613   FORMAT(' ',4X,A38,' = ',F7.2)
614   FORMAT(' ',2X,'PSYCHOLOGICAL DATA (VN23)')
615   FORMAT(' ',2X,'TOP MANAGEMENT DATA (VNA)')
616   FORMAT(' ',2X,'BEHAVIORAL DATA (VNCI)')
620   FORMAT(' ', 'YOU ENTERED SCALE VALUE ',F4.0)
650   FORMAT (I1)
660   FORMAT(' ', 'TYPE 1 TO SEE A-D,R-T. OTHERWISE TYPE 2.')
700   FORMAT(' ')
710   FORMAT(' ',27X,'SUMMARY REPORT')
711   FORMAT(' ',13X,'-----')
712   FORMAT(' ',14X,'RESULTS AT LAST CYCLE:')
713   FORMAT(' ',36X,'RAW',4X,'%MAX')
714   FORMAT(' ',35X,'SCORE',3X,'SCORE')
715   FORMAT(' ',35X,'-----',3X,'-----')
716   FORMAT(' ',10X,'BEHAVIORAL ERRORS ',7X,F5.1,4X,F4.0)
717   FORMAT(' ',10X,'PSYCHOLOGICAL ERRORS',5X,F5.1,4X,F4.0)
718   FORMAT(' ',10X,'MANAGEMENT ERRORS',8X,F5.1,4X,F4.0)
720   FORMAT(' ',27X,'MANAGEMENT REPORT')

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721  FORMAT(' ',13X,'-----')
722  FORMAT(' ',4X,F5.1,1X,'% OF ALL CREW MEMBERS EXPERIENCING ',
2    'THESE CIRCUMSTANCES')
723  FORMAT(' ',15X,'MAY BE KILLED WITHIN THE NEXT YEAR')
725  FORMAT(' ',5X,'THE SUBJECTS CHANCES OF BEING KILLED',
2    ' UNDER THESE CIRCUMSTANCES')
727  FORMAT(' ',15X,'ARE',1X,F4.2,1X,'IN 10')
800  FORMAT(' ',18X,'NO BEHAVIORAL THRESHOLD WAS PENETRATED')
801  FORMAT(' ',18X,'A BEHAVIORAL THRESHOLD WAS PENETRATED')
810  FORMAT(' ',26X,'% FATALITIES BY SOURCES')
811  FORMAT(' ',19X,'-----')
813  FORMAT(' ',17X,'100-',20X,'**')
814  FORMAT(' ',17X,'100-')
815  FORMAT(' ',20X,'-',20X,'**')
816  FORMAT(' ',3X,'% FATALITIES',3X,'50-',20X,'**')
817  FORMAT(' ',20X,'-')
818  FORMAT(' ',19X,'0-',20X,'**')
819  FORMAT(' ',3X,'% FATALITIES',3X,'50-')
820  FORMAT(' ',32X,'-----')
821  FORMAT(' ',30X,'-----')
822  FORMAT(' ',32X,'-----')
823  FORMAT(' ',32X,'BEHAVIORAL SOURCES')
824  FORMAT(' ',30X,'PSYCHOLOGICAL SOURCES')
825  FORMAT(' ',32X,'MANAGEMENT SOURCES')
850  FORMAT(' ',A6,2X,A10)
851  FORMAT(' ',16X,'-----')
C
1850  CONTINUE
C USER WILL ENTER A CASE IDENTIFIER (CSNO) SEE FORMAT 609
  WRITE(*,'(A)') ENTER A NAME FOR THIS CASE :
  WRITE(*,'(A)') EACH RUN OF THIS PROGRAM WILL HAVE A UNIQUE 5-DIGI
IT NAME:
  READ(*,1202) CSNO
  WRITE(6,700)
  WRITE(6,700)
  WRITE(6,700)
  WRITE(6,700)
  WRITE(6,609)CSNO
  WRITE(6,611)
  WRITE(6,700)
  WRITE(6,612)
  WRITE(6,613)'JOB PHYSICAL ANNOYANCES (PA) ',PA
  WRITE(6,613)'PRODUCTION PRESSURE AND FATIGUE (PPF)' ,PPF
  WRITE(6,613)'PERCEIVED JOB/ROLE AMBIGUITY (PJA) ',PJA
  WRITE(6,613)'ECONOMIC CLIMATE AND REWARD (PEC) ',PEC
  WRITE(6,613)'STRESSFUL LIFE EVENTS (SLE) ',SLE
  WRITE(6,613)'PHYSIOLOGICAL ABILITIES (PS) ',PS
  WRITE(6,613)'FOREMAN MANAGERIAL ABILITIES (XMA) ',XMA
  WRITE(6,613)'ADJUSTIVE BEHAVIOR (XAJB) ',XAJB
  WRITE(6,613)'ADJUSTIVE BEHAVIOR OVERRIDE (AJBO) ',AJBO
  WRITE(6,700)
C
  WRITE(6,614)
  WRITE(6,613)'TRAINING IN PATTERN RECOGNITION (X1) ',X1

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WRITE(6,613)'ALERTNESS AND OBSERVATION (X2)           ',X2
WRITE(6,613)'DISCRIMINATORY ABILITIES (X3)           ',X3
WRITE(6,700)
WRITE(6,615)
WRITE(6,613)'CONCERN FOR SAFETY (XNA)                 ',XNA
WRITE(6,700)
WRITE(6,616)
WRITE(6,613)'VOLATILITY (Y1)                         ',Y1
WRITE(6,613)'MACHOISM (Y2)                           ',Y2
WRITE(6,613)'CONSISTENCY (Y3)                        ',Y3
WRITE(6,613)'INFLUENCE ON OTHERS (Y4)                ',Y4
WRITE(6,700)
C DETERMINE WHETHER OR NOT THE FOREMAN CONTROLS ADJUSTIVE BEHAVIORS
C IF AJBO = 1.0 THEN HE DOES NOT AND THE VALUE XAJB PREVAILS
  IF (AJBO.EQ.1) GO TO 63
  IF (AJBO.EQ.0) GO TO 64
63  AJB = XAJB
    GO TO 39
64  CONTINUE
C DETERMINE WHICH ADJUSTIVE BEHAVIOR OCCURS UNDER THE FOREMAN'S CONTROL
  IF (XMA.EQ.6) GO TO 52
  IF (XMA.EQ.5) GO TO 54
  IF (XMA.EQ.4) GO TO 56
  IF (XMA.EQ.3) GO TO 58
  IF (XMA.EQ.2) GO TO 60
  IF (XMA.LT.2) GO TO 61
52  AJB=5.0
    GO TO 62
54  AJB = 4.0
    GO TO 62
56  AJB = 3.0
    GO TO 62
58  AJB = 2.0
    GO TO 62
60  AJB = 1.0
    GO TO 62
61  AJB = 0.0
62  CONTINUE
C CALCULATE INDIVIDUAL THRESHOLD VALUES, BASED ON CATASTROPHE THEORY
39  TH1=((PJA/95 + PEC/95 + SLE/95)*PS)*1.667
    TH2=((PA/95 + PPF/95 + SLE/95)*PS)*1.667
C CHECK FOR THRESHOLD PENETRATION
  IF (TH1.GT.2.OR.TH2.GT.2) GO TO 40
C THRESHOLD WAS NOT PENETRATED AND THE IMPULSE DECAYED
C CALCULATE PRE-PROCESSOR FACTORS UNDER DECAY,
C BASED ON ADJUSTIVE BEHAVIOR MODELS
C
  FAC = (TH1+TH2)/10.5
  DP13 = (FAC**.5)/1.5
C CHECK VALUE OF ADJUSTIVE BEHAVIORS SCORE (AJB)
  IF (AJB.EQ.0) GO TO 70
  IF (AJB.EQ.1) GO TO 71

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        IF (AJB.EQ.2) GO TO 72
        IF (AJB.EQ.3) GO TO 73
        IF (AJB.EQ.4) GO TO 74
        IF (AJB.EQ.5) GO TO 75
C DETERMINE PRE-PROCESSOR SCORE
C WHEN AGGRESSION OCCURS
70     PI13 = DP13
        GO TO 50
C WHEN WITHDRAWAL OCCURS
71     PI13 = (DP13-0.10)
        GO TO 76
72     PI13 = DP13-0.20
        GO TO 76
C WHEN COMPROMISE OCCURS
73     PI13= (DP13-0.30)
        GO TO 76
C WHEN ADAPTATION OCCURS
74     PI13=(DP13-0.40)
        GOTO 76
C WHEN CONSULTATION OCCURS
75     PI13 = (DP13-0.50)
76     IF (PI13) 77,50,50
77     PI13 = 0.0
        GO TO 50
40     CONTINUE
C MAKE CATASTROPHE CALCULATIONS, USING THE CUSP CATASTROPHE MODEL
        XP13 = (0.3*(TH1/10)**2)**.3333
        YP13 = (0.3*(TH2/10)**2)**.3333
        CP13 = (XP13+YP13)*1.18
C CHECK VALUE OF ADJUSTIVE BEHAVIORS SCORE (AJB)
        IF (AJB.EQ.0) GO TO 42
        IF (AJB.EQ.1) GO TO 43
        IF (AJB.EQ.2) GO TO 44
        IF (AJB.EQ.3) GO TO 45
        IF (AJB.EQ.4) GO TO 46
        IF (AJB.EQ.5) GO TO 47
C WHEN AGGRESSION OCCURS DETERMINE THE PRE-PROCESSOR SCORE,
C BASED ON ADJUSTIVE BEHAVIOR MODELS
C
42     PI13 = CP13
        GO TO 50
C WHEN WITHDRAWAL OCCURS
43     PI13 = (CP13-0.10)
        GO TO 48
C WHEN SUBLIMATION OCCURS
44     PI13 = (CP13-0.20)
        GO TO 48
C WHEN COMPROMISE OCCURS
45     PI13 = (CP13-0.30)
        GO TO 48
C WHEN ADAPTATION OCCURS
46     PI13 = (CP13-0.40)
        GO TO 48

```


C WHEN CONSULTATION OCCURS

47 PI13 = (CP13-0.50)

48 IF (PI13) 49,50,50

49 PI13=0.0

GO TO 50

C COMPUTE THE TERMINAL VALUES AT EACH OF THE THIRTEEN NODES

50 CONTINUE

VN2 = VNA * VRA2

VNJ = VN2 * VR2J

VN16 = VNJ * VRJ16 + (VNA * VRA16)

VN13 = VN23 * VR2313 + (VNJ * VRJ13)+PI13

VNC = (VN13 * VR13C) + VNCI

VN12 = (VN23 * VR2312) + (VNA * VRA12) + (VNC * VRC12)

VN24 = (VN23 * VR2324) + (VN13 * VR1324)

VN25 = (VN23 * VR2325) + (VN13 * VR1325)

C THE USE OF SUBVARIABLES A AND B FACILITATES CHECKING AND DEBUGGING

A = (VNC * VRC10) + (VN16 * VR1610) + (VNJ * VRJ10)

B = (VN23 * VR2310) + (VN12 * VR1210) + (VN25 * VR2510)

VN10 = A + B

C THE USE OF SUBVARIABLES C AND D FACILITATES CHECKING AND DEBUGGING

C = (VN10 * VR1011) + (VNA * VRA11) + (VNJ * VRJ11)

D = (VNC * VRC11) + (VN25 * VR2511)

VN11 = C + D

C THE USE OF SUBVARIABLES R, S AND T FACILITATES CHECKING AND DEBUGGING

R = (VN11 * VR11I) + (VN2 * VR2I) + (VNJ * VRJI)

S = (VN13 * VR13I) + (VN12 * VR12I) + (VN25 * VR25I)

T = (VN24 * VR24I)

VNI = R + S + T

IF (OUT.EQ.0)GOTO 21

C PRINT DETAILED OUTPUT REPORTS

C PRINT OUT BASE CASE VALUES

WRITE(6,700)

WRITE(6,700)

WRITE(6,608)

WRITE(6,851)

WRITE(6,700)

WRITE(6,700)

WRITE(6,609)CSNO

WRITE(6,700)

IF(TH1.GT.2.OR.TH2.GT.2) GO TO 4

WRITE(6,800)

WRITE(6,700)

GO TO 98

4 WRITE(6,801)

WRITE(6,700)

98 WRITE(6,605)

WRITE(6,700)

WRITE(6, 540)

WRITE(6,530)

WRITE(6,540)

WRITE(6,200)VN2, VNJ

WRITE(6,300) VN16, VN13

WRITE(6,400) VNC, VN12

WRITE(6,500) VN24, VN25

```

WRITE(6,510) VN10, VN11
WRITE(6,520) VNI
WRITE(6,700)
WRITE(6,606)
WRITE(6,541)'ENVIRONMENTAL (PI13)',PI13
WRITE(6,541)'BEHAVIORAL (VNCI)',VNCI
WRITE(6,541)'MANAGERIAL (VNA)',VNA
WRITE(6,541)'PSYCHOLOGICAL (VN23)',VN23
WRITE(6,700)
WRITE(6,604)
WRITE(6,602)'FC2413',FC2413
WRITE(6,602)'FC2513',FC2513
WRITE(6,602)'FCIC ',FCIC
WRITE(6,602)'VRCI ',VRCI
WRITE(6,700)
21 CONTINUE
C TWO LINES PRINT660, ACCEPT 650,J NEED TO BE ADDED TO INPUT AT TERMINAL
C PRINT SUBVARIABLES IF REQUESTED BY VALUE OF VARIABLE J, FOR DEBUGGING
C INPUT THE PRINT CONTROL CHARACTERS FOR VARIABLES A, B, C, D, R, S AND T;
C IF J = 1 THEY PRINT OUT, OTHERWISE THEY DO NOT; J = 2 NO PRINTOUT
  J = 2
  IF (J.EQ.2) GO TO 3
  WRITE(6,600)'A',A,'B',B
  WRITE(6,600)'C',C,'D',D
  WRITE(6,600)'R',R,'S',S,'T',T
C MAKE FEEDBACKLOOP COMPUTATIONS
C CHECK TO SEE IF THERE IS A FEEDBACK LOOP FROM NODE 24 TO NODE 13
3 IF (FC2413) 901,10,5
C CALCULATE THE EFFECTS OF FEEDBACK LOOP 24 TO 13
C VFR2413 IS REPLACED BY X2413 BECAUSE OF VARIABLE NAME LENGTH RESTRICTIONS
5 X2413 = FC2413 * VR1324
C VF1NI IS THE FEEDBACK VALUE AT NODE I WHERE F1 DESIGNATES
C THIS AS FEEDBACK LOOP 24 TO 13, F2 IS FOR FEEDBACK LOOP 25 TO 13, ETC.
VF1N13 = VN13 + (VN24 * X2413)+PI13
VF1NC = VNCI + (VF1N13 * VR13C)
VF1N12 = (VF1NC * VRC12) + (VN23 * VR2312) + (VNA * VRA12)
VF1N24 = (VF1N13 * VR1324) + (VN23 * VR2324)
VF1N25 = (VF1N13 * VR1324) + (VN23 * VR2325)
C THE USE OF SUBVARIABLES FA1 AND FB1 FACILITATES CHECKING AND DEBUGGING
FA1 = (VN16*VR1610) + (VNJ*VRJ10) + (VF1NC*VRC10)
FB1 = (VN23*VR2310) + (VF1N12*VR1210) + (VF1N25*VR2510)
VF1N10 = FA1 + FB1
C THE USE OF SUBVARIABLES FC1 AND FD1 FACILITATES CHECKING AND DEBUGGING
FC1 = (VNA*VRA11) + (VNJ*VRJ11) + (VF1N10*VR1011)
FD1 = (VF1NC*VRC11) + (VF1N25*VR2511)
VF1N11 = FC1+FD1
C THE USE OF SUBVARIABLES FR1, FS1 AND FT1 FACILITATE CHECKING/DEBUGGING
FR1 =(VF1N11*VR11I)+(VN2*VR2I)+(VNJ*VRJI)
FS1 =(VF1N13*VR13I)+(VF1N12*VR12I)+(VF1N25*VR25I)
FT1=(VF1N24*VR24I)
VF1NI =FR1+FS1+FT1
IF (OUT.EQ.0) GO TO 22
C PRINT DETAILED OUTPUT REPORTS
C PRINTOUT FEEDBACK CASE FOR LOOP 24 TO 13

```

```

        WRITE(6,700)
        WRITE(6,540)
        WRITE(6,531)
        WRITE(6,532)
        WRITE(6,540)
        WRITE(6,200)VN2,VNJ
        WRITE(6,300)VN16,VF1N13
        WRITE(6,400)VF1NC,VF1N12
        WRITE(6,500)VF1N24,VF1N25
        WRITE(6,510)VF1N10,VF1N11
        WRITE(6,520)VF1NI
        WRITE(6,700)
        WRITE(6,601)'FC2413',FC2413
        WRITE(6,700)
22      CONTINUE
C CHECK TO SEE IF THERE IS A FEEDBACK LOOP FROM NODE 25 TO NODE 13
10      IF (FC2513) 901,20,11
C CALCULATE THE EFFECTS OF FEEDBACK LOOP 25 TO 13
C VFR2513 IS HEREAFTER REPLACED BY X2513 BECAUSE OF
C VARIABLE NAME LENGTH RESTRICTIONS
11      X2513 = FC2513*VR1325
C START FROM DIFFERENT NODE 13 VALUES DEPENDING ON WHETHER OR NOT
C FEEDBACK ROUTE 24 TO 13 EXISTS
C IF ROUTE 2413 EXISTS, THEN START FROM
C VF1N13. OTHERWISE, START FROM VN13.
        IF (FC2413) 901,12,13
12      VF2N13 = VN13+(VN25*X2513)
        GO TO 14
13      VF2N13=VF1N13+(VN25*X2513)+PI13
14      VF2NC=VNCI+(VF2N13*VR13C)
        VF2N12=(VF2NC*VRC12)+(VN23*VR2312)+(VNA*VRA12)
        VF2N24=(VF2N13*VR1324)+(VN23*VR2324)
        VF2N25=(VF2N13*VR1325)+(VN23*VR2325)
C THE USE OF SUBVARIABLES FA2 AND FB2 FACILITATE CHECKING/DEBUGGING
        FA2 = (VN16*VR1610)+(VNJ*VRJ10)+(VF2NC*VRC10)
        FB2 =(VN23*VR2310)+(VF2N12*VR1210)+(VF2N25*VR2510)
        VF2N10 = FA2 + FB2
C THE USE OF SUBVARIABLES FC2 AND FD2 FACILITATE CHECKING/DEBUGGING
        FC2 =(VNA*VRA11)+(VNJ*VRJ11)+(VF2N10*VR1011)
        FD2=(VF2NC*VRC11)+(VF2N25*VR2511)
        VF2N11 = FC2 + FD2
C THE USE OF SUBVARIABLES FR2, FS2 & FT2 FACILITATE CHECKING/DEBUGGING
        FR2=(VF2N11*VR111)+(VN2*VR2I)+(VNJ*VRJ1)
        FS2=(VF2N13*VR13I)+(VF2N12*VR12I)+(VF2N25*VR25I)
        FT2= (VF2N24*VR24I)
        VF2NI = FR2 + FS2 + FT2
        IF (OUT.EQ.0)GO TO 23
C PRINT DETAILED OUTPUT REPORTS
        WRITE(6,700)
        WRITE(6,540)
        WRITE(6,531)
        IF (FC2413) 901,17,16
16      WRITE(6,700)
        WRITE(6,532)

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```

WRITE(6,534)
17 WRITE(6,533)
WRITE(6,540)
WRITE(6,200)VN2,VNJ
WRITE(6,300)VN16,VF2N13
WRITE(6,400)VF2NC,VF2N12
WRITE(6,500)VF2N24,VF2N25
WRITE(6,510)VF2N10,VF2N11
WRITE(6,520)VF2NI
WRITE(6,700)
IF (FC2513.GT.0.AND.FC2413.GT.0) GO TO 18
IF (FC2513.EQ.0) GO TO 19
IF (FC2413.EQ.0) GO TO 19
18 WRITE(6,601)'FC2413',FC2413
19 WRITE(6,601)'FC2513',FC2513
WRITE(6,700)
23 CONTINUE
C CHECK TO SEE IF THERE IS A FEEDBACK LOOP FROM NODE I TO NODE C
20 IF (FCIC) 901,902,30
C CALCULATE THE EFFECTS OF FEEDBACK LOOP I TO C
30 VFRIC = FCIC * VRCI
C START FROM DIFFERENT VALUES, DEPENDING ON WHETHER OR NOT OTHER
C FEEDBACK ROUTES EXIST
IF(FC2413.EQ.0.AND.FC2513.EQ.0) GO TO 31
IF(FC2413.GT.0.AND.FC2513.GT.0) GO TO 32
IF(FC2413.EQ.0.AND.FC2513.GT.0) GO TO 33
IF(FC2413.GT.0.AND.FC2513.EQ.0) GO TO 34
C THE FOLLOWING IS THE CASE WHERE ONLY FEEDBACK ROUTE
C I TO C EXISTS
31 VF3NC =VNC+(VNI*VFRIC)
VF3N12=VN12+(VF3NC*VRC12)
VF3N24=VN24
VF3N25=VN25
VF3N10=VN10+(VF3NC*VRC10)+(VF3N12*VR1210)
VF3N11=VN11+(VF3N10*VR1011)
VF3NI=VNI+(VF3N11*VR111)+(VF3N12*VR121)
IF (OUT.EQ.0) GO TO 24
C PRINT DETAILED OUTPUT REPORTS
WRITE(6,700)
WRITE(6,540)
WRITE(6,531)
WRITE(6,535)
WRITE(6,540)
WRITE(6,200)VN2,VNJ
WRITE(6,300)VN16,VN13
WRITE(6,400)VF3NC,VF3N12
WRITE(6,500)VF3N24,VF3N25
WRITE(6,510)VF3N10,VF3N11
WRITE(6,520)VF3NI
WRITE(6,700)
WRITE(6,601)'VFRIC',VFRIC
WRITE(6,700)
24 CONTINUE
GO TO 902

```

C THE FOLLOWING IS FOR THE CASE WHERE FEEDBACK ROUTES 24 TO 13,
C 25 TO 13 AND I TO C ALL EXIST

32 $VF2N13 = VF1N13 + (VN25 * X2513) + (VNI * VFRIC) + PI13$

$VF2NC = VNC + (VF2N13 * VR13C)$

$VF3NC = VF2NC + (VF2NI * VFRIC)$

$VF3N12 = (VF3NC * VRC12) + VF2N12$

$VF3N24 = (VF2N13 * VR1324) + (VN23 * VR2324)$

$VF3N25 = (VF2N13 * VR1325) + (VN23 * VR2325)$

C THE USE OF SUBVARIABLES FA3 AND FB3 FACILITATE CHECKING & DEBUGGING

$FA3 = (VN16 * VR1610) + (VNJ * VRJ10) + (VF3NC * VRC10)$

$FB3 = (VN23 * VR2310) + (VF3N12 * VR1210) + (VF3N25 * VR2510)$

$VF3N10 = FA3 + FB3$

C THE USE OF SUBVARIABLES FC3 AND FD3 FACILITATE CHECKING & DEBUGGING

$FC3 = (VNA * VRA11) + (VNJ * VRJ11) + (VF3N10 * VR1011)$

$FD3 = (VF3NC * VRC11) + (VF3N25 * VR2511)$

$VF3N11 = FC3 + FD3$

C THE USE OF SUBVARIABLES FR3, FS3 & FT3 FACILITATE CHECKING & DEBUGGING

$FR3 = (VF3N11 * VR11I) + (VN2 * VR2I) + (VNJ * VRJI)$

$FS3 = (VF2N13 * VR13I) + (VF3N12 * VR12I) + (VF3N25 * VR25I)$

$FT3 = (VF3N24 * VR24I)$

$VF3NI = FR3 + FS3 + FT3$

IF (OUT.EQ.0) GO TO 25

C PRINT DETAILED OUTPUT REPORTS

WRITE(6,700)

WRITE(6,540)

WRITE(6,531)

WRITE(6,535)

WRITE(6,534)

WRITE(6,533)

WRITE(6,534)

WRITE(6,532)

WRITE(6,540)

WRITE(6,200)VN2,VNJ

WRITE(6,300)VN16,VF2N13

WRITE(6,400)VF3NC,VF3N12

WRITE(6,500)VF3N24,VF3N25

WRITE(6,510)VF3N10,VF3N11

WRITE(6,520)VF3NI

WRITE(6,700)

WRITE(6,601)'VFRIC',VFRIC

WRITE(6,601)'FC2413',FC2413

WRITE(6,601)'FC2513',FC2513

25 CONTINUE

GO TO 902

C THE FOLLOWING IS FOR THE CASE WHERE FEEDBACK ROUTES 2413 AND IC
C EXIST BUT ROUTE 2513 DOES NOT

34 $VF3NC = VF1NC + (VF1NI * VFRIC)$

$VF3N12 = VF1N12 + (VF3NC * VRC12)$

$VF3N24 = VF1N24$

$VF3N25 = VF1N25$

$VF3N10 = VF1N10 + (VF3NC * VRC10)$

$VF3N11 = VF1N11 + (VF3N10 * VR1011)$

$VF3NI = VF1NI + (VF3N11 * VR11I) + (VF1N12 * VR12I)$

IF (OUT.EQ.0) GO TO 26

C PRINT DETAILED OUTPUT REPORTS

```

WRITE(6,700)
WRITE(6,540)
WRITE(6,531)
WRITE(6,535)
WRITE(6,534)
WRITE(6,532)
WRITE(6,540)
WRITE(6,200)VN2,VNJ
WRITE(6,300)VN16,VF1N13
WRITE(6,400)VF3NC,VF3N12
WRITE(6,500)VF3N24,VF3N25
WRITE(6,510)VF3N10,VF3N11
WRITE(6,520) VF3NI
WRITE(6,700)
WRITE(6,601)'VFRIC',VFRIC
WRITE(6,700)

```

26 CONTINUE
GO TO 902

C THE FOLLOWING IS THE CASE WHERE FEEDBACK ROUTES 2513 AND IC
C EXIST BUT ROUTE 2413 DOES NOT

33 $VX13 = (VN25 * X2513) + VN13 + PI13$
 $VF3NC = VNCI + (VX13 * VR13C) + (VNI * VFRIC)$
 $VF3N12 = (VN23 * VR2312) + (VNA * VRA12) + (VF3NC * VRC12)$
 $VF3N24 = (VX13 * VR1324) + (VN23 * VR2324)$
 $VF3N25 = VN25$
 $VF3N10 = (VF3NC * VRC10) + VNC$
 $VF3N11 = (VF3N10 * VR1011) + VN11$
 $VF3NI = (VF3N11 * VR11I) + VNI$
 IF (OUT.EQ.0) GO TO 902

C PRINT DETAILED OUTPUT REPORTS

```

WRITE(6,700)
WRITE(6,540)
WRITE(6,531)
WRITE(6,535)
WRITE(6,534)
WRITE(6,533)
WRITE(6,540)
WRITE(6,200)VN2,VNJ
WRITE(6,300)VN16,VX13
WRITE(6,400)VF3NC,VF3N12
WRITE(6,500)VF3N24,VF3N25
WRITE(6,510)VF3N10,VF3N11
WRITE(6,520)VF3NI
WRITE(6,700)
WRITE(6,601)'VFRIC',VFRIC

```

902 CONTINUE
IF (SOUT.EQ.0) GO TO 27

C PRINT NETWORK SUMMARY REPORTS

```

WRITE(6,700)
WRITE(6,700)
WRITE(6,710)
WRITE(6,711)
WRITE(6,700)

```



```

        WRITE(6,609)CSNO
        IF (TH1.GT.2.OR.TH2.GT.2) GO TO 28
        WRITE(6,800)
        GO TO 29
28      WRITE(6,801)
29      CONTINUE
        WRITE(6,700)
        WRITE(6,712)
        WRITE(6,700)
        WRITE(6,713)
        WRITE(6,714)
        WRITE(6,715)
C MAKE %MAX CALCULATIONS FOR THE SUMMARY REPORT
C SELECT THE MOST RECENT DATA
        IF (FC2413.GT.0.OR.FC2513.GT.0.OR.FCIC.GT.0) GO TO 99
        Z = VNI
        X = VN16
        Y = VN12
        GO TO 97
99      Z = VF3NI
        X = VN16
        Y = VF3N12
97      VNIM = (Z/150)*100.0
        IF(VNIM.GT.100) GO TO 9
        GO TO 8
9      VNIM=100
8      VN12M = (Y/40)*100.
        IF(VN12M.GT.100) GO TO 2
        GO TO 1
2      VN12M=100
1      VN16M = (X/3)*100.
        IF(VN16M.GT.100) GO TO 91
        GO TO 93
91      VN16M=100
93      WRITE(6,716) Z,VNIM
        WRITE(6,717)Y,VN12M
        WRITE(6,718)X,VN16M
        WRITE(6,700)
        WRITE(6,700)
27      IF (REM.EQ.0) GO TO 15
C PRINT MANAGEMENT REPORT
        WRITE(6,720)
        WRITE(6,721)
        WRITE(6,700)
        WRITE(6,609)CSNO
        WRITE(6,700)
C MAKE % DEATHS (PD) CALCULATION
        IF (Z.GT.30) GO TO 201
        PD = (.40)*Z
        GO TO 6
201      IF(Z.GT.90) GO TO 202
        PD = ((1.0667)*Z)-20.0
        GO TO 6
202      PD = ((.3333)*Z)+46.0

```

```

        IF (PD.GT.100) GO TO 7
        GO TO 6
7       PD=100
C MAKE CHANCES OF BEING KILLED (XIC) CALCULATIONS
6       XIC = (Z/137.3) * 12.5
C       700???
        WRITE(6,700)
C       700???
        WRITE(6,700)
        WRITE(6,700)
        WRITE(6,722)PD
        WRITE(6,723)
        WRITE(6,700)
        WRITE(6,700)
        WRITE(6,700)
        WRITE(6,725)
        IF(XIC.GT.10)GO TO 41
        IF(XIC.EQ.10) GO TO 41
        WRITE(6,727)XIC
        GOTO 35
41      CIC = 9.99
        WRITE(6,727)CIC
15      CONTINUE
35      IF(GRF.EQ.0) GOTO 994
C THIS ROUTINE GENERATES GRAPHICS BY PRINTING BAR CHARTS
C OF THE % FATALITIES
C
C PRINT HEADINGS
        WRITE(6,700)
        WRITE(6,700)
        WRITE(6,700)
        WRITE(6,700)
        WRITE(6,810)
        WRITE(6,811)
        WRITE(6,700)
        WRITE(6,609)CSNO
C
C CALCULATE THE VARIABLES THAT DETERMINE THE HEIGHT OF THE BAR
C CHARTS, N1, N2 AND N3, WHICH ARE THE NUMBERS OF LINE DISTANCES
C BELOW THE 100% POINT ON THE ORDINATE.
        N1= (100.00-VN1M)/10.0
        N2 = (100.00-VN12M)/10.0
        N3 = (100.00 -VN16M)/10.0
C
C GENERATE BEHAVIORAL GRAPHICS REPORT
C PRINT REPORT HEADING
C
        WRITE(6,700)
        WRITE(6,700)
        WRITE(6,823)
        WRITE(6,820)
        WRITE(6,700)
        IF (N1.LT.5) GO TO 110
C PRINT THE TOP PART OF THE ORDINATE SCALE

```

```

        WRITE(6,814)
        DO 100, I = 1,4
        WRITE(6,817)
100    CONTINUE
        IF (N1.EQ.5) GO TO 102
        WRITE(6,819)
        IF (N1.EQ.6) GO TO 105
C SET THE DO LOOP COUNTER
        M = (N1-6)
C PRINT THE LOWER PART OF THE ORDINATE SCALE WITHOUT DATA
        DO 107, I=1,M
        WRITE(6,817)
107    CONTINUE
        IF (N1.EQ.10) GO TO 104
C SET THE DO LOOP COUNTER
105    N = (10-N1)
C PRINT THE LOWER PART OF THE ORDINATE SCALE WITH DATA
        DO 108, I= 1,N
        WRITE(6,815)
108    CONTINUE
        GO TO 104
C FOLLOWING IS THE CASE WHERE N1 EQUALS 5
C PRINT THE 50% LINE AND ALL OTHERS BELOW IT WITH DATA
102    WRITE(6,816)
        DO 103, I=1,4
        WRITE(6,815)
103    CONTINUE
C PRINT THE ORIGIN LINE
104    WRITE(6,818)
        GO TO 120
C
C THE FOLLOWING IS FOR THE CASE WHERE N1 IS LESS THAN 5
C
110    IF (N1.EQ.0) GO TO 117
        WRITE(6,814)
        IF (N1.EQ.1) GO TO 118
C SET COUNTER AND PRINT ORDINATE WITHOUT DATA
        N = N1-1
        DO 111, I = 1,N
        WRITE(6,817)
111    CONTINUE
C SET COUNTER AND PRINT ORDINATE WITH DATA
        M = 5 - N1
        DO 112, I = 1,M
        WRITE(6,815)
112    CONTINUE
        GO TO 116
C CASE WHERE N1 EQUALS ZERO
117    WRITE(6,813)
C CASE WHERE N1 EQUALS ZERO OR ONE
118    DO 114, I = 1,4
        WRITE(6,815)
114    CONTINUE
C COMPLETE THE SCALE WITH DATA

```



```

116  WRITE(6,816)
      DO 113, I = 1,4
      WRITE(6,815)
113  CONTINUE
      WRITE(6,818)
C
C GENERATE PSYCHOLOGICAL GRAPHICS REPORT
C
120  WRITE(6,700)
      WRITE(6,700)
      WRITE(6,824)
      WRITE(6,821)
      WRITE(6,700)
      IF (N2.LT.5) GO TO 131
C PRINT THE TOP PART OF THE ORDINATE SCALE
      WRITE(6,814)
      DO 121, I = 1,4
      WRITE(6,817)
121  CONTINUE
      IF (N2.EQ.5) GO TO 123
      WRITE(6,819)
      IF (N2.EQ.6) GO TO 126
C SET THE DO LOOP COUNTER
      M= (N2-6)
C PRINT THE LOWER PART OF THE ORDINATE SCALE WITHOUT DATA
      DO 128, I=1,M
      WRITE(6,817)
128  CONTINUE
      IF(N2.EQ.10) GO TO 125
C SET THE DO LOOP COUNTER
126  N = (10-N2)
C PRINT THE LOWER PART OF THE ORDINATE SCALE WITH DATA
      DO 129, I=1,N
      WRITE(6,815)
129  CONTINUE
      GO TO 125
C FOLLOWING IS THE CASE WHERE N2 EQUALS 5
C PRINT THE 50% LINE AND ALL OTHERS BELOW IT WITH DATA
123  WRITE(6,816)
      DO 124, I=1,4
      WRITE(6,815)
124  CONTINUE
C PRINT THE ORIGIN LINE
125  WRITE(6,818)
      GO TO 141
C THE FOLLOWING IS FOR THE CASE WHERE N2 IS LESS THAN 5
C
131  IF (N2.EQ.0) GO TO 138
      WRITE(6,814)
      IF (N2.EQ.1) GO TO 139
C SET COUNTER AND PRINT ORDINATE WITHOUT DATA
      N = N2-1
      DO 132, I=1,N
      WRITE(6,817)

```

```

132  CONTINUE
C SET COUNTER AND PRINT ORDINATE WITH DATA
      M=5-N2
      DO 133, I=1,M
      WRITE(6,815)
133  CONTINUE
      GO TO 137
C CASE WHERE N2 EQUALS ZERO
138  WRITE(6,813)
C CASE WHERE N2 EQUALS ZERO OR ONE
139  DO 135, I=1,4
      WRITE(6,815)
135  CONTINUE
C COMPLETE THE SCALE WITH DATA
137  WRITE(6,816)
      DO 134, I=1,4
      WRITE(6,815)
134  CONTINUE
      WRITE(6,818)
C
C GENERATE MANAGEMENT GRAPHICS REPORT
C
141  WRITE(6,700)
      WRITE(6,700)
      WRITE(6,825)
      WRITE(6,822)
      WRITE(6,700)
      IF (N3.LT.5) GO TO 160
C PRINT THE TOP PART OF THE ORDINATE SCALE
      WRITE(6,814)
      DO 150, I=1,4
      WRITE(6,817)
150  CONTINUE
      IF (N3.EQ.5) GO TO 152
      WRITE(6,819)
      IF (N3.EQ.6) GO TO 155
C SET THE DO LOOP COUNTER
      M = (N3-6)
C PRINT THE LOWER PART OF THE ORDINATE SCALE WITHOUT DATA
      DO 157, I=1,M
      WRITE(6,817)
157  CONTINUE
      IF (N3.EQ.10) GO TO 154
C SET THE DO LOOP COUNTER AND RUN THE DO LOOP
155  N = (10-N3)
C PRINT THE LOWER PART OF THE ORDINATE SCALE WITH DATA
      DO 158, I=1,N
      WRITE(6,815)
158  CONTINUE
      GO TO 154
C FOLLOWING IS THE CASE WHERE N3 EQUALS 5
C PRINT THE 50% LINE AND ALL OTHERS BELOW IT WITH DATA
152  WRITE(6,816)
      DO 153, I=1,4

```

```

        WRITE(6,815)
153  CONTINUE
C PRINT THE ORIGIN LINE
154  WRITE(6,818)
        GO TO 994
C THE FOLLOWING IS FOR THE CASE WHERE N3 IS LESS THAN 5
C
160  IF (N3.EQ.0) GO TO 167
        WRITE(6,814)
        IF (N3.EQ.1) GO TO 168
C SET COUNTER AND PRINT ORDINATE WITHOUT DATA
        N =N3-1
        DO 161, I=1,N
        WRITE(6,817)
161  CONTINUE
C SET COUNTER AND PRINT ORDINATE WITH DATA
        M=5-N3
        DO 162, I= 1,M
        WRITE(6,815)
162  CONTINUE
        GO TO 166
C CASE WHERE N3 EQUALS ZERO
167  WRITE(6,813)
C CASE WHERE N3 EQUALS ZERO OR ONE
168  DO 164, I= 1,4
        WRITE(6,815)
164  CONTINUE
C COMPLETE THE SCALE WITH DATA
166  WRITE(6,816)
        DO 163, I = 1,4
        WRITE(6,815)
163  CONTINUE
        WRITE(6,818)
        WRITE(6,700)
        GO TO 1890
901  WRITE(6,521)
C SET VALUES FOR CHANGES IN PROGRAM, 0 FOR CONTINUE INPUT
C AS FOR NEW CASE, 1 TO RETURN TO LINE 994 TO CHANGE MENU
C TEST AS I.E., IF( .EQ. ) GO TO APPROPRIATE PLACE
1890  ICHGE=0
C        ENVIRONMENTAL PRE-PROCESSOR CHANGE
        ICHGP=0
C        PSYCHOLOGICAL PRE-PROCESSOR CHANGE
        ICHGB=0
C        BEHAVIORAL PRE-PROCESSOR CHANGE
        ICHGM=0
C        MANAGEMENT PRE-PROCESSOR CHANGE
        ICHGF=0
C        FEEDBACK COEFICIENT CHANGE
        IRUN=0
C        RUN PROGRAM AFTER CHANGES
        IREP=0
C        CHANGE REPORT FORMATS FOR RUN
994  WRITE(*,'(A)')'ODO YOU WANT TO:'

```

```

WRITE(*,'(A)'),' CHANGE ENVIRONMENTAL PRE-PROCESSORS: 1'
WRITE(*,'(A)'),' CHANGE PSYCHOLOGICAL PRE-PROCESSORS: 2'
WRITE(*,'(A)'),' CHANGE BEHAVIORAL PRE-PROCESSORS: 3'
WRITE(*,'(A)'),' CHANGE MANAGERIAL PRE-PROCESSORS: 4'
WRITE(*,'(A)'),' CHANGE FEEDBACK LOOPS: 5'
WRITE(*,'(A)'),' START A NEW CASE: 6'
WRITE(*,'(A)'),' CHANGE REPORT FORMATS: 7'
WRITE(6,700)
WRITE(*,'(A)'),' RUN THE PROGRAM WITH THESE CHANGES: 8'
WRITE(*,'(A)'),' QUIT THIS PROGRAM: 0'
WRITE(*,'(A)'),' YOU WILL BE RETURNED TO THIS MENU AFTER EACH'
WRITE(*,'(A)'),' CHANGE UNTIL YOU ARE READY TO RE-RUN THE CASE,'
WRITE(*,'(A)'),' START A NEW CASE, OR QUIT'
WRITE(*,'(A)'),' ENTER NUMBER OF YOUR CHOICE'
READ(*,1200)ICHO
IF(ICHO.EQ.1) GO TO 996
IF(ICHO.EQ.2) GO TO 992
IF(ICHO.EQ.3) GO TO 993
IF(ICHO.EQ.4) GO TO 991
IF(ICHO.EQ.5) GO TO 997
IF(ICHO.EQ.6) GO TO 1701
IF(ICHO.EQ.7) GO TO 2055
IF(ICHO.EQ.8) GO TO 1850
IF(ICHO.EQ.0) GO TO 995
IF(ICHO.GT.8) GO TO 994
C LOOPS FOR CHANGES IN VARIABLES VALUES
991 ICHGM=1
GO TO 1840
992 ICHGP=1
GO TO 1820
993 ICHGB=1
GO TO 1830
C IQUIT IS VARIABLE TO INDICATE ENDING OF PROGRAM
995 WRITE(*,'(A)'),' YOU MAY NOW TERMINATE THE PROGRAM. TYPE 0 TO END,'
WRITE(*,'(A)'),' TYPE 1 TO CONTINUE.'
READ(*,1200)IQUIT
IF(IQUIT.EQ.0)GO TO 999
IF(IQUIT.EQ.1) GO TO 994
996 ICHGE=1
WRITE(*,'(A)'),' CHANGE ALL THE ENVIRONMENTAL PRE-PROCESSORS, OR '
WRITE(*,'(A)'),' INDICATE THE INDIVIDUAL PRE-PROCESSOR TO BE CHANGE
1D.'
1810 WRITE(*,'(A)'),' THE PROGRAM WILL RETURN TO THIS MENU AFTER EACH CH
ANGE,'
WRITE(*,'(A)'),' UNTIL YOU INDICATE YOU ARE FINISHED.'
WRITE(*,'(A)'),' CHANGE ALL ENVIRONMENTAL PRE-PROCESSORS
1 10'
WRITE(*,'(A)'),' JOB PHYSICAL ANNOYANCES (PA)
1 1'
WRITE(*,'(A)'),' PERCEIVED PRODUCTION PRESSURE AND FATIGUE (PPF)
1 2'
WRITE(*,'(A)'),' PERCEIVED JOB/ROLE AMBIGUITY AND ESTEEM (PJA)
1 3'
WRITE(*,'(A)'),' PERCEIVED ECONOMIC CLIMATE AND JOB REWARDS (PEC)

```



```

1  4'
  WRITE(*,'(A)')' STRESSFUL LIFE EVENT SCORE (SLE)
1  5'
  WRITE(*,'(A)')' PHYSIOLOGICAL STATE (PS)
1  6'
  WRITE(*,'(A)')' FOREMANS MANAGERIAL ABILITIES (XMA)
1  7'
  WRITE(*,'(A)')' ADJUSTIVE BEHAVIOR (XAJB)
1  8'
  WRITE(*,'(A)')' ADJUSTIVE BEHAVIOR OVERRIDE (AJBO)
1  9'
  WRITE(*,'(A)')' FINISHED CHANGING ENVIRONMENTAL PRE-PROCESSORS
1  0'

```

C THE VARIABLE IEPR IS AN INDICATOR FOR WHICH PRE-PROCESSOR TO CHANGE

```

  READ(*,1200)IEPR
  IF(IEPR.EQ.10) GO TO 1811
  IF(IEPR.EQ.1) GO TO 1303
  IF(IEPR.EQ.2) GO TO 1302
  IF(IEPR.EQ.3) GO TO 1305
  IF(IEPR.EQ.4) GO TO 1307
  IF(IEPR.EQ.5) GO TO 1309
  IF(IEPR.EQ.6) GO TO 1311
  IF(IEPR.EQ.7) GO TO 1313
  IF(IEPR.EQ.8) GO TO 1315
  IF(IEPR.EQ.9) GO TO 1317
  IF(IEPR.EQ.0) GO TO 994

```

C PUT ERROR ROUTINE HERE

```

997  ICHGF=1
      GO TO 1860
999  END

```

APPENDIX B.--PRINTOUTS FROM BAS FOR SAMPLE CASES

BAS QUESTION AND ANSWER DIALOG FOR CASE #1

IF YOU WISH TO SEE DETAILED OUTPUT REPORTS

TYPE 1, OTHERWISE TYPE 0

1

THERE ARE A VARIETY OF REPORTS AND GRAPHS WHICH YOU
MIGHT LIKE TO HAVE PRINTED OUT.

TYPE 1 TO CHOOSE ONE OR MORE. OTHERWISE TYPE 0

1

IF YOU WISH TO SEE THE NETWORK FLOW SUMMARY REPORT

TYPE 1, OTHERWISE TYPE 0

1

IF YOU WANT TO SEE THE MANAGEMENT REPORT, TYPE 1, OTHERWISE TYPE 0

1

IF YOU WISH TO SEE THE GRAPH OF THE RESULTS, TYPE 1, OTHERWISE TYPE 0

1

ENTER DATA FOR THE PSYCHOLOGICAL STATE PRE-PROCESSOR

ENTER ONLY 0 OR 1, NO OTHER

FOR TRAINING: 1 = PERSON HAS BEEN TRAINED IN PATTERN RECOGNITION

0 = NO TRAINING, OR DO NOT KNOW

0

FOR ALERTNESS: 1 = POOR OBSERVER, MISSES DETAILS

0 = HIGHLY ALERT, VERY OBSERVANT OR DO NOT KNOW

1

FOR DISCRIMINATORY ABILITIES: 1 = POOR DISCRIMINATOR

PERSON MIGHT NOT KNOW APPROPRIATE ACTION IN AN EMERGENCY

0 = GOOD DISCRIMINATOR, KNOWS APPROPRIATE ACTION OR DO NOT KNOW

1

ENTER DATA FOR MANAGERIAL PRE-PROCESSOR

YOU MAY ENTER ANY NUMBER FROM 0 TO 1.0;

MODAL VALUE = 0.50

1.0 = TOP MANAGEMENT SHOWS THE MAXIMUM CONCERN POSSIBLE

FOR SAFETY; 0 = TOP MANAGEMENT SHOWS MINIMUM

CONCERN FOR SAFETY. VALUES RANGE FROM 0 TO 1.0.

1.0

ENTER DATA FOR BEHAVIORAL PRE-PROCESSOR

FOR VOLATILITY: 1 = PERSON IS UNINFORMED,

GOES OFF HALF-COCKED OR SELDOM LOOKS BEFORE HE LEAPS

OR TAKES UNNECESSARY RISKS

0 = LOW OR NO RISK TAKING, OR DO NOT KNOW

1

FOR MACHOISM: 1 = DOES THINGS HIS OWN WAY, HAS

LITTLE REGARD FOR RULES, CONVENTIONS OR PROCEDURES

0 = LOW MACHOISM OR DO NOT KNOW

1

FOR CONSISTENCY: 1 = PERSON SHOWS CONSISTENT BEHAVIORS

0 = BEHAVIORS CHANGE FROM DAY TO DAY, OR DO NOT KNOW

0

DO YOU WANT TO INCLUDE FEEDBACK LOOPS? TYPE 1 FOR YES
TYPE 0 FOR NO.

1

INPUT FC VALUE FOR FEEDBACK LOOP 25 TO 13.
VALUES CAN BE FROM 0 TO 1.0; MODAL VALUE = .20

.20

INPUT FC VALUE FOR FEEDBACK LOOP 24 TO 13
VALUES CAN BE FROM 0 TO 1.0; MODAL VALUE = .20

.20

INPUT FC VALUE FOR FEEDBACK LOOP I TO C
VALUES CAN BE FROM 0 TO 1.0; MODAL VALUE = .20

.20

ENTER DATA FOR THE ENVIRONMENTAL PRE-PROCESSOR SCALES.
IF YOU CANNOT DETERMINE A SCALE VALUE, TYPE 0
TO ABORT THE PROGRAM.

ENTER THE SCALE VALUE FOR JOB PHYSICAL ANNOYANCE (PA)
RANGE 10-100, 10=LOW

100

ENTER A VALUE FOR PRODUCTION PRESSURE AND FATIGUE (PPF)
RANGE 10-100, 10=LOW

100

ENTER A VALUE FOR PERCEIVED JOB AND ROLE AMBIGUITY (PJA)
RANGE 10-100, 10=LOW

100

ENTER A VALUE FOR PERCEIVED ECONOMIC CLIMATE AND JOB
REWARD (PEC). RANGE 10-100, 10=HIGH

100

ENTER A VALUE FOR STRESSFUL PERSONAL LIFE EVENTS (SLE)
ENTER ANY NUMBER FROM 0 TO 100.

100 = MAXIMUM, 0 = NO STRESSFUL EVENTS

100

ENTER A VALUE FOR PHYSIOLOGICAL ABILITY STATE (PS)
ENTER EITHER 1 OR 2. 1=ADEQUATE, 2=INADEQUATE

1

DETERMINE THE VALUE OF FOREMAN MANAGERIAL ABILITIES (XMA)
RATE THE FOLLOWING SIX CRITERIA, EITHER 1 OR 0
1 = HE HAS THE SKILL; 0= HE DOES NOT HAVE THE SKILL
LEADERSHIP SKILL, ENTER 1 OR 0

1

INTERPERSONAL SKILL, ENTER 1 OR 0

0

TECHNICAL SKILL, ENTER 1 OR 0

0

PLANNING SKILL, ENTER 1 OR 0

0

COMMUNICATION SKILL, ENTER 1 OR 0

0

DIRECTING SKILL, ENTER 1 OR 0

0

ENTER ONE NUMBER FOR ADJUSTIVE BEHAVIORS (XAJB)
CHOOSE EITHER: 0=AGGRESSION, 1=WITHDRAWAL, 2=SUBLIMATION
3=COMPROMISE, 4=ADAPTATION, 5=CONSULTATION

0

ENTER A VALUE FOR ADJUSTIVE BEHAVIOR OVERRIDE (AJBO)
 ENTER 1 IF INDIVIDUAL ADJUSTS OWN BEHAVIOR WITHOUT
 FOREMAN INVOLVEMENT OR
 ENTER 0 IF FOREMAN CONTROLS INDIVIDUALS ADJUSTIVE BEHAVIOR
 0

ENTER A NAME FOR THIS CASE :
 EACH RUN OF THIS PROGRAM WILL HAVE A UNIQUE 5-DIGIT NAME:
 #1
 File name missing or blank - Please enter name
 UNIT 6?
 CASE1

DO YOU WANT TO:
 CHANGE ENVIRONMENTAL PRE-PROCESSORS: 1
 CHANGE PSYCHOLOGICAL PRE-PROCESSORS: 2
 CHANGE BEHAVIORAL PRE-PROCESSORS: 3
 CHANGE MANAGERIAL PRE-PROCESSORS: 4
 CHANGE FEEDBACK LOOPS: 5
 START A NEW CASE: 6
 CHANGE REPORT FORMATS: 7
 RUN THE PROGRAM WITH THESE CHANGES: 8
 QUIT THIS PROGRAM: 0

YOU WILL BE RETURNED TO THIS MENU AFTER EACH
 CHANGE UNTIL YOU ARE READY TO RE-RUN THE CASE,
 START A NEW CASE, OR QUIT
 ENTER NUMBER OF YOUR CHOICE
 0

YOU MAY NOW TERMINATE THE PROGRAM. TYPE 0 TO END,
 TYPE 1 TO CONTINUE.
 0

BAS OUTPUTS FOR CASE #1

THE INPUT DATA FOR THIS CASE ARE:

ENVIRONMENTAL DATA (PI13)

JOB PHYSICAL ANNOYANCES (PA)	=	100.00
PRODUCTION PRESSURE AND FATIGUE (PPF)	=	100.00
PERCEIVED JOB/ROLE AMBIGUITY (PJA)	=	100.00
ECONOMIC CLIMATE AND REWARD (PEC)	=	100.00
STRESSFUL LIFE EVENTS (SLE)	=	100.00
PHYSIOLOGICAL ABILITIES (PS)	=	1.00
FOREMAN MANAGERIAL ABILITIES (XMA)	=	1.00
ADJUSTIVE BEHAVIOR (XAJB)	=	.00
ADJUSTIVE BEHAVIOR OVERRIDE (AJBO)	=	.00

PSYCHOLOGICAL DATA (VN23)

TRAINING IN PATTERN RECOGNITION (X1)	=	.00
ALERTNESS AND OBSERVATION (X2)	=	1.00
DISCRIMINATORY ABILITIES (X3)	=	1.00

TOP MANAGEMENT DATA (VNA)

CONCERN FOR SAFETY (XNA)	=	1.00
--------------------------	---	------

BEHAVIORAL DATA (VNCI)

VOLATILITY (Y1)	=	1.00
MACHOISM (Y2)	=	1.00
CONSISTENCY (Y3)	=	.00
INFLUENCE ON OTHERS (Y4)	=	1.00

DETAILED OUTPUT REPORT

CASE : #1

A BEHAVIORAL THRESHOLD WAS PENETRATED

NETWORK FLOW OUTPUTS

ENTROPY VALUES WITH FEEDBACK

LOOP 24 TO 13

AND

LOOP 25 TO 13

VN2=	.037	VNJ=	.030
VN16=	.073	VN13=	5.424
VNC=	6.594	VN12=	7.026
VN24=	5.486	VN25=	5.726
VN10=	16.490	VN11=	23.344
VNI=	37.541		

FC2413 = .200

FC2513 = .200

ENTROPY VALUES WITH FEEDBACK

LOOP I TO C

AND

LOOP 25 TO 13

AND

LOOP 24 TO 13

VN2=	.037	VNJ=	.030
VN16=	.073	VN13=	9.806
VNC=	20.371	VN12=	24.342
VN24=	8.817	VN25=	9.276
VN10=	44.409	VN11=	60.811
VNI=	89.896		

VFRIC = .200

FC2413 = .200

FC2513 = .200

SUMMARY REPORT

CASE:#1

A BEHAVIORAL THRESHOLD WAS PENETRATED

RESULTS AT LAST CYCLE:

	RAW SCORE -----	%MAX SCORE -----
BEHAVIORAL ERRORS	89.9	60.
PSYCHOLOGICAL ERRORS	24.3	61.
MANAGEMENT ERRORS	.1	2.

MANAGEMENT REPORT

CASE:#1

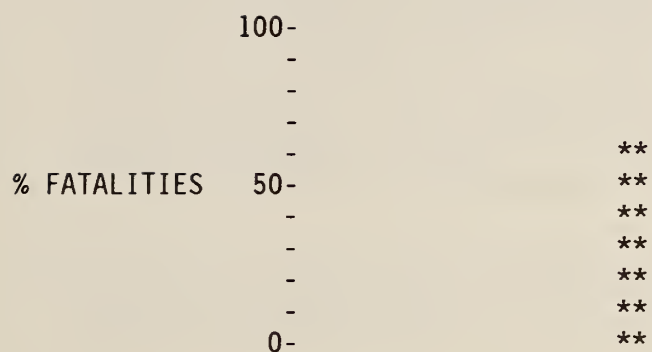
75.9 % OF ALL CREW MEMBERS EXPERIENCING THESE CIRCUMSTANCES
MAY BE KILLED WITHIN THE NEXT YEAR

THE SUBJECTS CHANCES OF BEING KILLED UNDER THESE CIRCUMSTANCES
ARE 8.18 IN 10

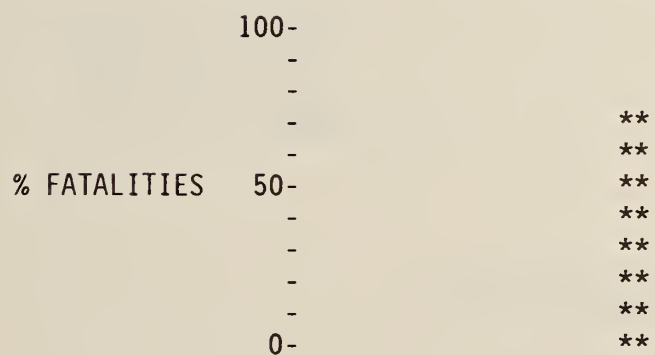
% FATALITIES BY SOURCES

CASE:#1

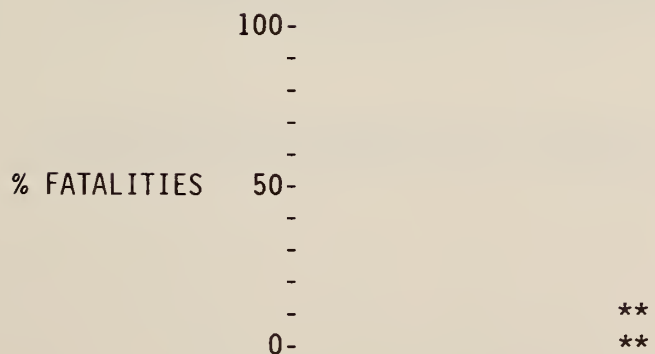
BEHAVIORAL SOURCES



PSYCHOLOGICAL SOURCES



MANAGEMENT SOURCES



CASE:#2

THE INPUT DATA FOR THIS CASE ARE:

ENVIRONMENTAL DATA (PI13)		
JOB PHYSICAL ANNOYANCES (PA)	=	100.00
PRODUCTION PRESSURE AND FATIGUE (PPF)	=	100.00
PERCEIVED JOB/ROLE AMBIGUITY (PJA)	=	100.00
ECONOMIC CLIMATE AND REWARD (PEC)	=	100.00
STRESSFUL LIFE EVENTS (SLE)	=	100.00
PHYSIOLOGICAL ABILITIES (PS)	=	1.00
FOREMAN MANAGERIAL ABILITIES (XMA)	=	6.00
ADJUSTIVE BEHAVIOR (XAJB)	=	.00
ADJUSTIVE BEHAVIOR OVERRIDE (AJBO)	=	.00
PSYCHOLOGICAL DATA (VN23)		
TRAINING IN PATTERN RECOGNITION (X1)	=	.00
ALERTNESS AND OBSERVATION (X2)	=	1.00
DISCRIMINATORY ABILITIES (X3)	=	1.00
TOP MANAGEMENT DATA (VNA)		
CONCERN FOR SAFETY (XNA)	=	1.00
BEHAVIORAL DATA (VNCI)		
VOLATILITY (Y1)	=	1.00
MACHOISM (Y2)	=	1.00
CONSISTENCY (Y3)	=	.00
INFLUENCE ON OTHERS (Y4)	=	1.00

MANAGEMENT REPORT

CASE:#2

57.2 % OF ALL CREW MEMBERS EXPERIENCING THESE CIRCUMSTANCES
MAY BE KILLED WITHIN THE NEXT YEAR

THE SUBJECTS CHANCES OF BEING KILLED UNDER THESE CIRCUMSTANCES
ARE 6.59 IN 10

CASE:#3

THE INPUT DATA FOR THIS CASE ARE:

ENVIRONMENTAL DATA (PI13)		
JOB PHYSICAL ANNOYANCES (PA)	=	10.00
PRODUCTION PRESSURE AND FATIGUE (PPF)	=	10.00
PERCEIVED JOB/ROLE AMBIGUITY (PJA)	=	10.00
ECONOMIC CLIMATE AND REWARD (PEC)	=	100.00
STRESSFUL LIFE EVENTS (SLE)	=	10.00
PHYSIOLOGICAL ABILITIES (PS)	=	1.00
FOREMAN MANAGERIAL ABILITIES (XMA)	=	6.00
ADJUSTIVE BEHAVIOR (XAJB)	=	.00
ADJUSTIVE BEHAVIOR OVERRIDE (AJBO)	=	.00
PSYCHOLOGICAL DATA (VN23)		
TRAINING IN PATTERN RECOGNITION (X1)	=	.00
ALERTNESS AND OBSERVATION (X2)	=	1.00
DISCRIMINATORY ABILITIES (X3)	=	1.00
TOP MANAGEMENT DATA (VNA)		
CONCERN FOR SAFETY (XNA)	=	1.00
BEHAVIORAL DATA (VNCI)		
VOLATILITY (Y1)	=	1.00
MACHOISM (Y2)	=	1.00
CONSISTENCY (Y3)	=	.00
INFLUENCE ON OTHERS (Y4)	=	1.00

MANAGEMENT REPORT

CASE:#3

37.4 % OF ALL CREW MEMBERS EXPERIENCING THESE CIRCUMSTANCES
MAY BE KILLED WITHIN THE NEXT YEAR

THE SUBJECTS CHANCES OF BEING KILLED UNDER THESE CIRCUMSTANCES
ARE 4.90 IN 10

CASE:#4

THE INPUT DATA FOR THIS CASE ARE:

ENVIRONMENTAL DATA (PI13)		
JOB PHYSICAL ANNOYANCES (PA)	=	10.00
PRODUCTION PRESSURE AND FATIGUE (PPF)	=	10.00
PERCEIVED JOB/ROLE AMBIGUITY (PJA)	=	10.00
ECONOMIC CLIMATE AND REWARD (PEC)	=	10.00
STRESSFUL LIFE EVENTS (SLE)	=	100.00
PHYSIOLOGICAL ABILITIES (PS)	=	1.00
FOREMAN MANAGERIAL ABILITIES (XMA)	=	6.00
ADJUSTIVE BEHAVIOR (XAJB)	=	.00
ADJUSTIVE BEHAVIOR OVERRIDE (AJBO)	=	.00
PSYCHOLOGICAL DATA (VN23)		
TRAINING IN PATTERN RECOGNITION (X1)	=	.00
ALERTNESS AND OBSERVATION (X2)	=	1.00
DISCRIMINATORY ABILITIES (X3)	=	1.00
TOP MANAGEMENT DATA (VNA)		
CONCERN FOR SAFETY (XNA)	=	1.00
BEHAVIORAL DATA (VNCI)		
VOLATILITY (Y1)	=	1.00
MACHOISM (Y2)	=	1.00
CONSISTENCY (Y3)	=	.00
INFLUENCE ON OTHERS (Y4)	=	1.00

MANAGEMENT REPORT

CASE:#4

6.8 % OF ALL CREW MEMBERS EXPERIENCING THESE CIRCUMSTANCES
MAY BE KILLED WITHIN THE NEXT YEAR

THE SUBJECTS CHANCES OF BEING KILLED UNDER THESE CIRCUMSTANCES
ARE 1.54 IN 10

CASE: BEST

THE INPUT DATA FOR THIS CASE ARE:

ENVIRONMENTAL DATA (PI13)

JOB PHYSICAL ANNOYANCES (PA)	=	10.00
PRODUCTION PRESSURE AND FATIGUE (PPF)	=	10.00
PERCEIVED JOB/ROLE AMBIGUITY (PJA)	=	10.00
ECONOMIC CLIMATE AND REWARD (PEC)	=	10.00
STRESSFUL LIFE EVENTS (SLE)	=	.00
PHYSIOLOGICAL ABILITIES (PS)	=	1.00
FOREMAN MANAGERIAL ABILITIES (XMA)	=	6.00
ADJUSTIVE BEHAVIOR (XAJB)	=	5.00
ADJUSTIVE BEHAVIOR OVERRIDE (AJBO)	=	.00

PSYCHOLOGICAL DATA (VN23)

TRAINING IN PATTERN RECOGNITION (X1)	=	1.00
ALERTNESS AND OBSERVATION (X2)	=	.00
DISCRIMINATORY ABILITIES (X3)	=	.00

TOP MANAGEMENT DATA (VNA)

CONCERN FOR SAFETY (XNA)	=	1.00
--------------------------	---	------

BEHAVIORAL DATA (VNCI)

VOLATILITY (Y1)	=	.00
MACHOISM (Y2)	=	.00
CONSISTENCY (Y3)	=	1.00
INFLUENCE ON OTHERS (Y4)	=	.00

MANAGEMENT REPORT

CASE : BEST

.6 % OF ALL CREW MEMBERS EXPERIENCING THESE CIRCUMSTANCES
MAY BE KILLED WITHIN THE NEXT YEAR

THE SUBJECTS CHANCES OF BEING KILLED UNDER THESE CIRCUMSTANCES
ARE .13 IN 10

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